# MY EXPERIENCES IN SOVIET RUSSIA

MEGHNAD SAHA, F. R. S.

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# PREFACE

The collection of articles which mainly form this little book contain my impressions of the Soviet Union where I went for the first time during the summer of 1925, as an Indian delegate to the 220th Anniversary of the Russian Academy of Sciences

They are more in the nature of journalistic snapshots than any detailed study of the topics discussed

Some of these articles were published in a local daily, but on account of my pre-occupation in other directions I found no time in putting them together in the form of a book

This has at last been achieved through the enterprise of Messrs The Bookman to whom my grateful thanks are due.

M. N SAHA

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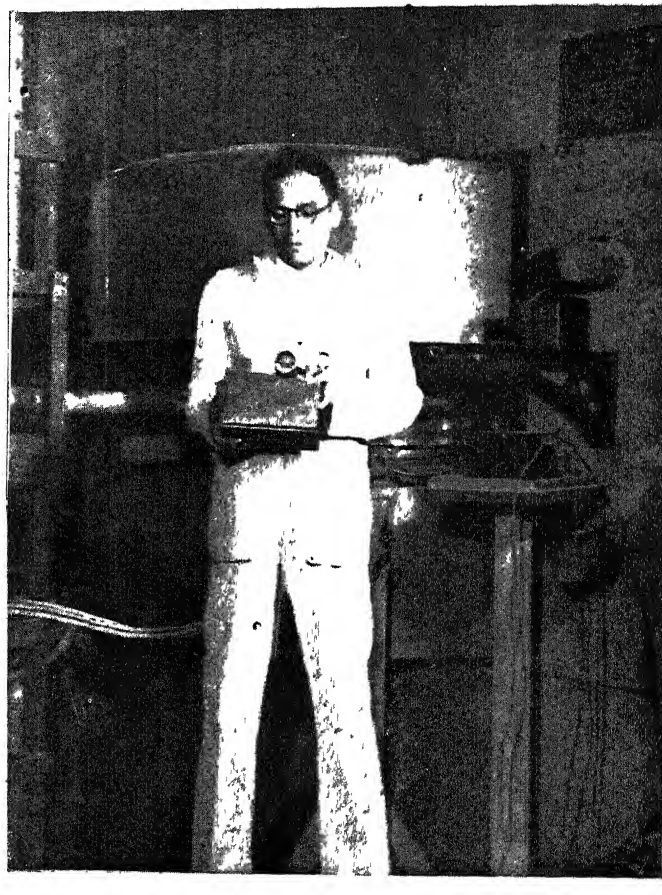


The author photographed in the Cyclotron Laboratory, Calcutta University, January, 1947

# I

# Towards Tomorrow Via Yesterday

SOVIET RUSSIA has been a mystery land to most of us during the last twenty-seven years, since she took to a new way of life after the Revolution of 1917.

The vast amount of propaganda literature, of the Rightist and the Leftist variety, which has been pouring in incessant blasts during all these years, has further deepened the fog. But the victorious emergence of Soviet Russia in her four years' struggle against the mightiest military machine the world has ever seen, has provided the most convincing proof of the soundness of the ethics of socialist doctrines and of the efficacy of Soviet methods.

When, therefore, I received an invitation from President Komarov to attend the 220th anniversary of the U.S.S.R Academy of Sciences, the chance of obtaining a firsthand knowledge of this mystery land immediately after the termination of hostilities in Europe, weighed heavily on my decision to accept the invitation, which I did almost within five minutes, in spite of my having recently returned after a long tour to the U. K. and U.S.A.

The usual formalities for getting the passport and air passage were gone through quickly enough through the courtesy of Sir Olaf Caroe, Secretary for External Affairs, Government of India, and the air transport officials, to whom I take this opportunity of expressing my sincerest thanks.

Unfortunately, neither of the other Indian delegates (Dr. Shyamaprasad Mookerjee and Sir C. V. Raman) turned up, but the apprehensions of making a solo journey were dispelled when I met at the Air office, Dr. Joseph Needham, F.R.S., Sir William Dunn Reader in Biochemistry in the University of Cambridge, who as Head of the British Scientific Mission in China, has for the last three years been rendering signal service to China In this self-imposed task Dr. Needham is helped by his wife, Mrs. Needham, who is also a distinguished biochemist like himself. He had just arrived from Chungking after an eleven-hour air journey, and was arranging his air passage to Moscow to attend the Jubilee Session; he was invited to explain his scheme of international co-operation in Science, amongst the different nations of the world. This scheme was forwarded to the San Francisco Conference for adoption.

Besides being an eminent authority on his own subject, Dr. Needham has a wide interest in other spheres of life, and has acquired extensive experience of conditions in China during the war-period and wide knowledge of ancient and medieval Chinese science and culture. He was stranded for months in the north-western part of China, where he had gone to visit the Buddhist cave temples of Tun Huang, (caves of a Thousand Buddhas) described by Sir Aurel Stein and other explorers There he spent most of his time in photographing, and taking records of the frescoes and other remains in the company of a Lama, and hopes to publish his experiences as soon as he is released from his present self-imposed duties I am sure this will be a great contribution to the subject.

STARTING from the Dum Dum aerodrome at 6 a.m. on June 7, we arrived at Karachi after short stops at Allahabad and Delhi. At Karachi, the formalities of getting an Iranian visa from the Iranian Consul were quickly gone through, thanks to the efforts of my former

pupil, Mr. Manindra Nath Chakravorti, M.Sc., the Officer-in-charge of Railway Transport for Karachi Harbour. I spent the night at his house. We took off from Karachi in the morning and arrived at Basrah after successively calling at Jiwani in Baluchistan, Shaga in Oman, and the Bahrein Islands.

At Basrah, we spent the night in Hotel Shat-el-Arab, a luxurious hotel with air-conditioned rooms maintained by British Overseas Airways Corporation on the bank of the Shat-el-Arab river which is the name given to the united streams of the Tigris and the Euphrates. The city of Sindbad the Sailor has got few attractions excepting monotonous groves of date-palms. Next morning we arrived at Baghdad after a short flight of two hours over the swamps and marshes which make up the ancient cradles of civilisation. Sumer and Akkad, now called Iraq, and were lodged in the Hotel Regent Palace (June 9)

I must acknowledge here the help I received through letters of introduction to Mr Stonehewer Bird, British Minister at Baghdad, and to H. E. Sir Bullard, His Majesty's Ambassador in Iran, given to me, at my request, by H. E. Mr. R. G. Casey, the Governor of Bengal.

In a foreign country, the problem of getting transit visas, currency, and accommodation, sometimes prove very troublesome, and may entirely spoil the journey. In fact, the Chinese delegate, who came after us, was held up at Calcutta and Baghdad for a number of days, and reached Moscow only on June 28, the last day of the Conference. Thus in a sense Dr. Needham was the only Chinese delegate at the celebrations. But we had no such difficulty, thanks to the help rendered to us by British and Indian officers at Baghdad and Teheran, who were appraised of our arrival before hand by the Government of India.

I had visited Baghdad in 1936 and I found that the city had not changed much since. The city is on both

banks of the broad and swiftly-flowing Tigris, and most of the important buildings are on the two river banks.

We had to change our commodious Ensign plane at Baghdad, for the flight to Teheran is usually arranged in a smaller plane which comes bi-weekly from Cairo. We had to wait for the plane till June 11. We utilized this interval in visiting the Iraqi National Museum and other places of interest at Baghdad, the historic monuments of the Sassanian Emperors at Ctesiphon, twenty-five miles from Baghdad.

THE members of the British Council, Mr. Morray and Mr. Simcox, rendered us great help. In the Iraqi Museum, which contains the archaeological finds of this ancient land right from 4,000 B.C., we had the full panorama of Mesopotamian history of 6,000 years before us.

Here we made the acquaintance of His Excellency Dr. Sayyad Naji el Asil, Director-General of Antiquities, one of the leading Iraqis of the present times, who has several times held the portfolio of Education. The antiquities were explained to us at great length by Dr. Seton Lloyd, of the Museum, who has written a fine book, "Twin Rivers", illustrating the history of Iraq during almost six milleniums.

The Iraqi Government has got a number of young Iraqis trained in England and America under eminent scholars like Henri Frankfurt, and one of them, Mr. Taha Baguir is now curator of the Museum. The excavation work is now being mostly carried out by Iraqis.

*The Iraqi Museum is a mine of information on the ancient history of the Near East, and should be visited frequently by Indian scholars, for the discovery of the Indus Valley civilization has shown that intimate trade relations existed between the Indus Valley and Mesopotamia about* 2500 *B.C. probably before the advent of the Aryans.*

In fact, Dr. Seton Lloyd showed us "Seals" obtained by Dr. Frankfurt in his excavations at Tell Asman, which contain many Indian motifs and prove that trade existed between India and Iraq even before 2,500 B. C. The only difficulty in the way of Indians going to Iraq at the present time is the high inflation, which appears to be eight times the normal level.

The city of Harun-al-Raschid contains but a few monuments of the Abbasid times. With the exception of a few mosques, the gorgeous city of the Abbasid Caliphs has been almost completely effaced by successive Mongol and Turkish hordes, a feat which is being repeated in modern times in Europe by the European Nations

A few years ago, an ancient palace was excavated on the east bank of the Tigris and has been identified as the palace of Caliph At Mamun (807-833 A.D.), son of the famous Harun-al-Raschid, himself a scholar, and patron of learning, and professing the Mutazzil (rationalist) doctrines.

WE left Baghdad on June 11, at 12 noon and reached Teheran at 3 p m. The flight took place over the Zagros Mountains, over Kermanshah, and Hamadan, ancient Ecbatana. We were met at the aerodrome by Mr. Ghazanfar Ali Naqvi, attache for Indian affairs at the British Embassy at Teheran, Mr. F. S. Madan, an Indian businessman (Parsi), long settled at Teheran, and Mr Owen, representative of the British Council.

Mr. Madan, who has married an Iranian lady, was kind enough to offer me the hospitality of his home during my stay at Teheran, which I gladly accepted. I met a number of distinguished Iranians at his house, amongst them Dr. Ali Ashaqar Hekmat, who had been several times Education Minister and had recently visited India as head of the Iranian Cultural Mission. Mr. Hekmat is a man of enlightened views and well-

conversant with ancient and modern Iranian history. Dr. Needham stayed with Mr. Owen.

Travellers to Iran should be careful to arrange beforehand all the formalities of passport, visa, and hotel accommodation, since as already pointed out, inflation has reached the figure of 900 1200 per cent., and good hotels cost nearly Rs 60 to Rs. 80 per day.

I was informed by Mr. Naqvi that Pandit Rahul Sankrityayan, the eminent Buddhist scholar and explorer, had to wait several months before his papers could be straightened up for his journey to Russia. He has joined the Oriental section of the U. S. S. R. Academy of Sciences at Leningrad for Buddhistic studies. I later met him at Leningrad, and he confirmed the account given by Mr. Naqvi.

There are a large number of Indians in Teheran —merchants, officials, personnel employed in the different armies of occupation, and pilgrims, and through the motor route from Zahidan on the Indian border through Bab, Karman, Kashan to Teheran (a distance of 1,400 miles) pass every day fresh batches of Indians.

Teheran has a pleasant situation at the foothills of the Elburz mountain range which skirts Iran on the northern side The snowclad conical peak of Demavend (rising to a height of 18,000 ft.) is a conspicuous landmark in the sky and is considered the national symbol of Iran. Teheran has a population of about eight lakhs, and has been entirely rebuilt by His late Majesty Reza Shah Pehlevi, who provided his capital with fine buildings, and wide asphalt roads lined with trees. Indian admirers of Iranian culture have presented Teheran with a marble statue of the immortal Ferdausi. who wrote the Shah Namah at the court of Sultan Mahmud of Ghazni, and then ran away from his court. disdaining to accept silver in place of gold. The statue is being erected in Avenue Shah Reza, one of the finest Avenues of Teheran.

During the summer, the temperature is sometimes high in course of the day, but nights are always cool, and those who can afford it take villas in the beautiful suburb of Simrun, eight miles away, on the slopes of the Elburz range The city is full of fine gardens, for which Iran is famous, and the gorgeous Chenar tree, familiar to travellers in Kashmere, is found everywhere

While in Tehcran we paid a visit to the Iranian National Museum, which is one of the finest we ever saw, both as regards the building, and the arrangements for displaying the antiquities It was planned by M. Godet, a famous French archaeologist, but is now entirely managed by Iranian scholars. We were shown over the antiquities by Drs. Mustafavi and L. Bahrami.

The museum is very rich in its collections, containing finds from neolithic sites at Susa (3,000 B C.), and Eastern Iran, up to the finds at Passagade (capital of Cyrus 538 B. C.) Persepolis (capital of Darius 516—485 B.C.) and elsewhere, recently excavated by Dr Herzfeld. One can have here the entire perspective of Iranian history from the time of Cyrus and Darius (500 B.C.), to the Satavi times (1,704 A D.), but there are important gaps, for there appear to be no records of the Seleucid and Parthian times (300 B. C.—200 A.D.).

Dr. Bahrami explained that the absence of finds of these periods was due to the fact that the sites have not yet been touched by the archaeologist's spade.

*But it struck me that Indian scholars will probably learn much if they can afford to spend some time in this museum, and probably with the aid of materials available here, will be able to throw new light on the obscure period of Indian history from 100 B. C. to the time of the rise of the Guptas, in other words on the Greek-Saka-Kushan period.*

We were kindly invited to lunch by H. E. Sir Bullard, the British Ambassador, himself a great scholar of Persian history. We lunched in the same room where two years ago, the Big Three—Roosevelt, Churchill and Stalin—met to decide the direction of the war A brass tablet marks the place and the occasion

WE also visited the University, in the company of Dr Hessabi, Professor of Physics. Iran is sometimes called the France of the East, and I do not know whether this has been responsible for the choice of French by the Iranians as the cultural language. Every educated Iranian talks French, though English is now gradually replacing it. Reza Shah had plans of having fine and commodious buildings for the University at Teheran in a reserved university area. Although the buildings for the Faculties of Engineering and Medicine which are built in a modern style, are complete, not much apparatus has yet been collected to equip them satisfactorily. The other Faculties remain in the old city area.

Iran's national income is 400 million tomans (a toman is now a rupee), of which 200 million are spent on the army, and 20 on education. Iran will have, therefore, to wait long, before she can get the University which her thinking men want.

Mr. Naqvi, who was kind enough to offer me his hospitality of his home on my return journey, speaks Persian fluently, and knows almost every Iranian of rank and position. He is working hard for the Indo-Iranian Cultural Association, and through him, we were introduced to many Iranians of high positition, and to professors in the University. We also made the acquaintance of Dr. Semi, and Dr. Nafissy. President and Secretary, of the Iranian National Academy, who travelled with us to Moscow to join the 220th anniversary of the Academy.

At Teheran, the number of delegates increased by

the arrival of the American batch of about 16 delegates, and along with the Iranian delegates, we all left Teheran on June 14, at 5 p.m. in two Russian planes.

Amongst the American delegates were my old friends, Dr. Harlow Shapley, the eminent Harvard astronomer, who headed the delegation, Dr. Irving Langmuir, Nobel Laureate in Chemistry, Prof. J W. MacBain of the University of Stanford and many others. Dr. H. Shapley was an old friend, as I had stayed in his Observatory at Harvard for two months in 1936, as a visiting professor. We were naturally extremely glad to meet each other after nine years.

We flew over the Elburz, over the famous Mazendara province of Iran, which now forms its granary, reached the Caspian sea about an hour late, and halted at Baku at 7-45 a.m.

BAKU is itself in a flat plain skirting the Caspian, but is studded with the largest concentration of oil derricks in the world. Here we were welcomed by the Minister of Education, and a member of the Azerbaijan Academy, and treated to a sumptuous breakfast where we tasted for the first time the famous 'caveari', (egg of a fish which is found in large quantities in the Caspian Sea and is regarded as a great delicacy) and some of us, unwittingly, vodka, the Russian national drink It looked just like water and as we were thirsty we eagerly drank up the glasses before us, and had to repent afterwards.

The Azerbaijan country forms the eastern fringe of the Caucasus, and is divided into a Russian and an Iranian part. Our Iranian colleague, Dr Nafissy, who is an eminent scholar of the Avestan language, and of Pehlevi,* informed us that Azerbaijan is a corruption

*Pehlevi, or old Persian, was the language spoken in Iran before the Arab conquest of 640 A D It was a purely Aryan language derived from old Avestan, which was very near to Vedic Sanskrit. Pehlevi was the court language of the great Sassanid emperors who ruled Iran from 226 A D to 640 A D, and crossed swords on equal terms with the Roman emperors

of the old Iranian word 'Atropatrene' (keeper of fire). which denoted a high Persian official, who was deputed by the Achemenid Emperors, to look after the sacred ancient fires of Baku (from Athros—Vedic Atharvan fire; patrene or patri—keeper). Baku was a part of Iran till 1720, when it was conquered by Peter the Great for Russia. The perpetual fires of Baku have been known from ancient times.

It is now a large city of about a million people, and is capital of the Autonomous Republic of Azerbaijan.

Starting from Baku at 9 a.m we reached the Moscow aerodrome at 5-45 p.m We passed close to Stalingrad, but did not stop there. The broad Volga and the well-marked green and cultivated fields many of which appeared from their size to be collective farms, formed very good landmarks all along our course.

# II

# Glimpses of People and Life

THE AIRPORT OF Moscow, unlike other airports, is just within the city, and the air traveller has a chance of obtaining from the air a bird's eye view of the great Metropolis of Soviet Russia. One gets, on a clear day, a vivid view of the minarets and buildings of the Kremlin, the palace city of the hill on the banks of the Moscowa river, round which Moscow has been growing through the centuries. Moscow is a huge city, having a pre-war population of four and a half

millions. It is growing at a very fast rate and it is probable that within a few decades, it will overtake, if not surpass, London and New York. A large part of the population was evacuated during the German attacks of 1941-42, but as soon as the danger-period was over, people from the devastated regions began to flock back into the Metropolis. The city presents now a very crowded appearance, and the trams, buses and the underground are as crowded as in Calcutta, but unlike Calcutta the crowd waits in silence in long queues instead of wildly scrambling for seats. The principal roads in Moscow are fine, broad and scrupulously clean, and the numerous squares in the city are large

We were met at the aerodrome by the representatives of the British Embassy, members of the Academy, and officers of the In-tourist Bureau, and taken by the latter to the Hotel Metropol on the Sverdlov Square near the Kremlin. As soon as a tourist enters any part of the U.S.S.R. Republics, he is put in the hands of the officers of the In-tourist Bureau (mostly women with knowledge of principal foreign languages) who arrange hotel accommodation, conveyance, his visits to various places and perform other services.

Like all tourists, we were State guests during our sojourn in Russia, and on this occasion, having been specially invited for the celebrations, we enjoyed special privileges. We had our tour-programme fixed beforehand by the Academy, which included visits to Academy meetings, to research institutions, to dinners and lunch parties, to operas, to ballets and concerts, and cars would be waiting for us at the hotel at the appointed hour. If any of us expressed a desire to visit a particular institute or person not included in the agenda, special conveyance was provided in case the person was available and the institution was one which could be shown. If, by any chance, the car failed to arrive, it was not possible to get a taxi, for taxis do not exist, though the buses, trams and Moscow underground are available. However such occasions were few.

**Fellow Delegates**

The British delegates, about 20 in number, headed by Sir Robert Robinson, the famous organic chemist of Oxford and Vice-President of the Royal Society, were lodged in the same hotel as ourselves. The British delegation included Dr. Ogg, director of the Rothamstead experimental station, Dr. Henry Thomas, director of the British Museum, Professor Julian Huxley, grandson of the great Huxley and famous scientific writer, Sir Thomas Holland, for long director of the Geological Survey in India and member of the Viceroy's Cabinet during the first world war, and many others.

*Much dissatisfaction was evident amongst the Russian scientists, at the inability of the British Government to allow some of the distinguished British scientists to come to Russia, on the plea, which somehow did not appear quite convincing to our Russian friends, that they were urgently needed in England for important war work.*

The Americans were lodged in the Moscow and the National Hotels, and so were the French and delegates from some other parts of the world. The French party included Professors Joliot Curie, husband and wife, and joint Nobel prize-winners in physics, the latter being a daughter of the famous Madame Curie. Professor Joliot-Curie has now openly professed himself to be a Communist, and was Minister in the De Gaulle Cabinet for the reorganisation of scientific institutions and researches in France. A notable delegate was Dr. Szent-Gyorgyi, famous Cambridge-trained Hungarian biochemist, and Nobel prize-winner who informed me that he went 'underground' during the German occupation of Hungary.

There was a large number of representatives from all the eastern countries of Europe, excepting Germany, Italy, Spain and Turkey. Amongst Spanish American Republics only Mexico was represented by Dr. M. Vallarta, Dean of the Faculty of Science of the Univer-

sity of Mexico and a famous worker on Cosmic Rays, one with whom I had formed a friendship in 1936 during my stay at the Harvard College Observatory.

The Russians, naturally enough, attended the session in large numbers; it was their first holiday after four years continuous strain at the post of duty. They were very eager to learn from the foreign delegates all that had taken place in the world of science all these years.

**Once they were in darkness**

But the most impressive gatherings were those of the delegates from the constituent republics, which now have Academies of their own, or are having branches of the Supreme Academy at Moscow, some of which may be mentioned.

The Azerbaijan Academy, with head-quarters at Baku, sent a large contingent, headed by the President, Mir Asadulla Mir-Kasimov, who started life as a student of Arabic Theology, but is now a surgeon, specialising in abdominal surgery, and surgery of the urinary tract. The Academy has produced a galaxy of young scientists who have made remarkable progress in the study of oil—Azerbaijan's chief natural wealth—geology, the physical, technical and biological sciences and in the humanities

The Armenian Academy of Sciences, with head-quarters at Erivan, sent a fairly large number of delegates including Vice-President Ambarzumian, an astronomer whom I knew by his work. Other noted scientists of Armenian origin were the brothers Alichanov and Alichianin, who work on nuclear physics. The reader can easily see that they originally bore the good Islamic names of "Ali Khan," and have Russianized themselves, one brother by adding "ov", the other by "nin".

Alichanov had just been elected an Academician of the U.S.S.R. Academy of Sciences.

The Mongolian People's Republic, with its head-quarters at Ulan Bator, sent Dugersurun, a geologist; Shirekdov, a historian and Tinchin, a writer. The oblique-eyed Mongol scientist read one of the longest messages of welcome in his native "Uighur."

Kazakasthan Academy, with its head-quarters at Alma Atta, sent Uspanov, a soil scientist. I met others, but I cannot trace their names in my notes. There was Dzunaaev Oraz, soil scientist, from Turkmenisthan (Ashkabad), Romanov, professor of Mathematics at Samarkand, Ujbekisthan (Taskend), and some scientists from Tajikisthan (Stalinabad) and the Yakut Republic in the eastern extremity of Siberia. The whole of Central Asia and Siberia seem to be astir with scientific activity.

**They are better off**

During our stay, we had no occasion to use our own "money". I was told that the 'banks' give 24 roubles for a pound sterling, while the employees belonging to the British Embassy get 48 roubles. It was difficult to find out what a 'rouble' meant, so some of us decided to test the point experimentally. We went to a 'store' and asked for the prices of some ordinary articles. We were asked to pay 5 roubles for a lead pencil which cost two annas in the Calcutta market before the war, and 800 roubles for a good cotton shirt, which did not cost more than 15 shillings in the London market before the war. Books appeared to be cheap, but as they were mostly in Russian, they were not of much use to most of us. We had, therefore, to get our 'roubles' reconverted into our own currencies. I spent altogether '2' roubles from my pocket during my fortnight's stay in Russia.

We were told that every Russian, man, woman, or child, was given ration cards for every necessity of life, and according to his 'work' and 'position'. With the

ration card, he could buy just what was sufficient for him and the wages he got were sufficient for these, but if he wanted to get, say, an extra pair of shoes or shirts, for which he had no ration card, he could do so at the 'black (or white?) market', which were 'stores', run by Government officials, at ten to thirty times the price charged from a ration-card holder. But evidently there were different kinds of ration cards, for we did not find that everyone had to live at the same dead level We visited many 'Academicians' i.e. scientists who have achieved the distinction of being elected to the Academy (there are now altogether 139 Russian scientists who have achieved this distinction) in their private homes. We found that they have better quarters than many of us in corresponding positions in India, good private libraries, furniture, a motor car with a "chauffeur" at their disposal, who is generally found asleep in the car just like our own chauffeurs when they have to wait The Academicians maintain apparently good tables and are served with good cuisine, and have "chaprasis" at their beck and call Without appearing to be vain, many Indian scientists, including myself, can claim to be holding as good positions in the international world of science as some of the Russian Academicians but most of us, excepting a few, do not enjoy the amenities of life enjoyed by our Russian colleagues. From private enquiries I found that "scientists, teachers and educationists" lived in Soviet Russia on a much higher level than their *confreres* in India or even in some countries of Europe.

**Our Programme**

Our programme in Moscow was not very different from that of the Indian Science Congress; it consisted of visits to the opening meeting and other general meetings of the Academy, meetings of sections like those of physics, mathematics etc., visits to special research institutes, visits to the Kremlin, to a collective farm and to a State farm. For those of us who lived in hotels, the day started at 9 a.m. with a small breakfast. The lunch (or as they say, dinner) could be taken any time between 2

and 5 p m. and the supper (or dinner) any time between 8-30 p.m. and 11 p.m. The dullness of the evenings was relieved by visits to operas, concerts, cinemas and ballets which our hosts provided for us in plenty.

Some of our friends went to see the film "The Fall of Berlin" and described their impressions as very painful.

All the foreign delegates admitted that the Russian stage, (I include under this name all forms of entertainment, viz , theatres, operas, concerts etc.) was one of the best in the world The "stage" was revolving, and one had not to wait for a long period between two acts. The decorations, scenery, illumination, music and acting evoked universal admiration. An opera by Mikhail Glinka (1804-1857) "Ivan Susasnin", based on the patriotic poem by the great Russian poet, Pushkin was specially impressive.

It described the times when after the death of Ivan, 'the Terrible' (1610-1615) Russia fell into chaos, and Moscow was for some years occupied by an army of occupation sent by the Polish King Sigismund.

> *Russia would probably have become a vassal state of Poland, but for the spontaneous rising, in which nobles and peasantry equally participated, led by Prince Pozharsky, a nobleman, and Minin, a butcher from Novgorod The opera describes how a Russian peasant, Ivan Susasnin, forced by a Polish army sent by King Sigismund to the relief of the beleaguered Polish garrison in the Kremlin, to show them the way to Moscow, purposely led them to trackless jungles, effected their destruction, and sacrificed himself in the attempt.*

The ceremonial dinners were important features of the ceremony. We had three impressive dinners, one at Moscow given by the Academy; there were about 1500-2000 guests, it lasted from 7 to 12 P.M. and

second Academy dinner at Leningrad was on an even grander scale. The farewell dinner was given by the Supreme Prasidium of the Soviets at the Georgieski Hall of the Kremlin Palace. This dinner was accompanied by a programme of concerts, solos, music, ballets, Russian folk dances etc. which went on from 7 p.m. to 12-30 a.m. The members of the Prasidium, including Stalin himself, who sat at the head of the table, would frequently rise and drink to the health of the performers, for the performances were exceedingly good and evoked cheers from the guests.

**Russian Language**

The proceedings of the meetings were naturally enough carried out in Russian, but very few of the foreign delegates understood Russian. It was indeed boring to sit for hours together listening to lectures in a language which we did not understand, but politeness required that we should keep to our seats. The actually enjoyable hours were those when we met the Russian scientists in their institutes when we could talk with them in English, French or German, for most of the older generation of Russian scientists had been trained in foreign countries, particularly in Germany and can at least talk one of these languages well. Many of us did not consider it 'politic' to try to talk in German, but some of the Russian scientists themselves started talking in German. Others were averse to the use of German, and one of them told me that one should forget "that d—d language" now. The younger generation of Russian scientists, though they acquire a working knowledge of some of the principal European languages, cannot use them for conversational purposes, for unlike the older generation, few of them have been to foreign countries.

*But foreign scientists must now learn Russian, for an enormous amount of scientific work which is published in Russian, is carried out in Russia. Even an English, French or German summary which used to be appended earlier is now being omitted. There ought to be some arrangement in our universities for the teaching of Russian.*

It is very desirable that a foreign traveller should at least master the Russian script, so that he is able to read notices and street signs, but the Russian alphabet presents certain difficulties. Some of its symbols are taken from Greek, some from Latin, and some, expressing the exclusive Russian sounds, are entirely new. It is known as the "Cyrillic script" after a monk 'Cyril' who invented it for the use of the Slavonic people. Much confusion is caused by the fact that some symbols, though they have the same form as in Latin, have an entirely different meaning

The Russians have no 'h' sound. In fact, we were rather amused one day by one of our In-tourist ladies calling for 'Gholland' and it took us some time to find out that our friend Sir Thomas Holland was meant. They cannot say 'Teheran' but pronounce it as 'Teghren', Hydro as Gidro etc. They have no 'W' sound, but replace it by 'V'.

**Light and Shade**

There is now a tendency to locate all Research institutions of the Academy at Moscow, near the head-quarters of the Government. While some of the institutions like the Institute of Physical Problems which was specially built for my friend Dr. P. L. Kapitza, were quite new and built on a grand scale, others were housed in old buildings, evidently not originally meant to be laboratories. On enquiry, we found that they were mostly 'palaces' belonging to the Tsar or Grand Dukes or to the rich noblemen. The Academy was originally at Leningrad but in 1934 the head-quarters were transferred to Moscow, and accommodation was found in a building which was originally the 'summer palace' of the Tsar; but "The Sickle and the Hammer" were prominently engraved on the front side to make it look tolerably "Bolshevik." The Bolshevik Government had to bring into existence a large number of Research Institutes to give effective aid to their 'Five-Year Plans', and they solved the problem, for the time being at least, of finding accommodation for these institutes by diverting numerous 'palaces' and mansions of noblemen and merchants to

the use of science We found most of the big 'churches' abandoned; some of them, which have not been claimed by the 'flock', are being used as museums and schools.

Busts, statues, and pictures of Lenin and Stalin are to be found everywhere. In the minds of the newer U.S.S.R. citizens, Comrade Lenin has taken the place of Jesus Christ, Comrade Stalin that of St. Paul.

It is very difficult for a foreigner, not knowing Russian, to get any news of the outside world in Russia. 'The Moscow News', which is published three times a week is the only English newspaper. It is a two-sheet paper, containing the barest outline of world news For news of the outside world we had to depend upon type-written news-sheets, issued by the British and American Embassies.

To those who are accustomed to the luxury of large-sized American or British papers, the size and contents of Russian dailies will be somewhat disappointing. "Izvestia" (News), the official organ, contains more sheets than the others. "Pravda" (Truth), the organ of the Communist Party, is somewhat smaller in size than "Izvestia" I did not see any foreign paper in Moscow and Leningrad during my stay in Russia.

Russia is, however, publishing an enormous number of scientific, literary and technical journals, and those published by the Academy have not to be submitted to the censor. Foreign scientific and technical journals also appear to have free access to Russia, for I found that most of the laboratories I visited had received well-known foreign scientific periodicals.

We had two parties at the U.S S R Society for the Promotion of Cultural Relationship with Foreign Countries, popularly known as the V.O.K S , where we heard a very fine piano recital by a young man of about 28, Mr. E. Gilels, reputed to be the best pianist in Soviet Russia.

# III

# The Academy of Sciences

THE ACADEMY OF Sciences in Soviet Russia is a unique institution with fine traditions and record, but it came rather late in Russian national life. The Academy movement in Europe was the result of the Renaissance when science of the ancient peoples began to be known in Europe of the dark ages from contact with the Arabs. The movement found its best exponent in Francis Bacon, who in his 'New Atlantis' advocated the foundation of a Philosophers' Club for the co-operative study of sciences and their application to all walks of life. The movement led to the foundation of the Academy of the Lynxes at Rome in 1602, to be followed by the French Academy in Paris in 1634, and the Royal Society in London in 1663, but Russia lagged behind by nearly a century.

Readers of history are aware that up to 1700 A. D. Russia was an inland and Asiatic Empire. The whole of the Baltic coast belonged to Sweden, and the Caspian and Black Sea coastal regions to the south were under Turkey. Peter the Great who occupied the throne of Russia from 1682-1725 was the creator of European Russia. He wrested the Baltic provinces after a long war with Sweden, and tried to wrest the provinces on the Black Sea and the Caspian Sea after war with Turkey but in this effort he was not successful, and the conquest of these provinces had to wait till the reign of Catherine the Great, his grand daughter-in-law forty

years later. It was Peter who conquered the province of Baku from the Persians. Peter was as unconventional as the Bolsheviks, his spiritual heirs.

In 1702, Peter sent a political mission to Western Europe to which he attached himself as a private person under the pseudonym of "Peter Michailovich." He worked as a carpenter in the ship-building yards of Amsterdam and learnt to appreciate the useful arts, crafts and sciences practised in Western Europe. It is said that he paid a visit to the Royal Society and also to the French Academy of Sciences and conceived the idea of founding a similar institution in his own country as an important factor in his gigantic scheme for the country's development. The capital at St. Petersburg was founded by him in 1703 just to provide, as he said, "a window for Russia to the West" But on account of his other preoccupations, the foundation of the Academy took more time, though before his death he confirmed the statutes drawn up for its foundation. The Academy of Sciences was actually founded at St. Petersburg, now called Leningrad, in December 1725, a few months after his death, by his wife and successor, the Empress Catherine I, who sanctioned 4000 pounds for its maintenance

**Catherine I** For some reason, her name is being ignored persistently in the annals of Russia. She was the daughter of a Lithuanian peasant, and became the concubine of a Russian officer at whose house Peter first met her. Being captivated by her charms, he carried her to his own entourage Though illiterate, she was a woman of extraordinary shrewdness, intelligence and courage, and won not only Peter's heart but his head as well. In one of his campaigns against Turkey, Peter was almost caught in a trap by the Turkish commander, and it was only Catherine's diplomatic visit to the commander which saved Peter from destruction. Peter found his son Alexis weak of intellect and a tool in the hands of reactionaries. He caused him to be imprisoned and murdered and proclaimed Catherine as his successor, thus giving a rude

shock to the Russian Church and nobility. In spite of their opposition, she succeeded Peter as Empress, and within the short period of her reign (1725-1728) gave effect to many of the reforms contemplated earlier. As a matter of fact, after her death three years later, there was an eclipse in Peter's reforms till a second, and greater, Catherine came to the throne in 1763.

Though the Bolsheviks have renamed Peter's City after Lenin on the plea that Lenin worked mostly amongst the workers of this city, they seem to have a genuine respect for Peter's personality, dynamic energy, and his unconventionalism. The equestrian statue of Peter at Leningrad is a fine monument to the memory of the greatest of the unfortunate Romanovs. A respectful reference to Peter is apparently not regarded as betraying sympathy with the "Counter-revolution."

**The Birth of the Academy**

The members of the Academy, or academicians as they are called, were at first fifteen in number. They obtained a pension from the State and were expected to devote their lives to the pursuit of science and letters. The grants were subsequently raised to more substantial amounts. At first Russia had no scientific man worth the name, so most of the academicians had to be imported from Western Europe. Among these may be mentioned such great names as Nicholas and Daniel Bernouli, Euler, Jakobi whose names are known to every student of mathematics, and several others. During this period, there used to be a competition amongst the courts of St. Petersburg, Berlin and Paris for the possession of the greatest men of science. Physics, chemistry and biology had not yet arisen, so mathematics, astronomy and medicine were the only respectable sciences. Catherine II of Russia tried to get the great mathematician Lagrange to the court, but Frederick the Great of Prussia wrote a personal letter to Lagrange that it was the wish of the greatest King of Europe (meaning himself) to have the greatest mathematician of the age (meaning Lagrange) to grace his

court. The compliment was too much for Lagrange, and he decided for Berlin.

The researches in the Academy, as President Komarov remarked, were of an encyclopaedic character:

*"It was a period of struggle for a scientific outlook in all the deversified fields where members of the Academy were active. They fought for a rational interpretation of facts. The human mind freed from the scholastic way of reasoning, characteristic of the Middle Ages, refused to acknowledge the supremacy of any other authority. In the domain of natural science this tendency at the time expressed itself in a rational interpretation of Nature."*

**First Great Russian Scientist**

At this time also rose the first Russian man of science, Lomonosov (1711-1764) who made contributions to nearly all fields from chemistry to literature. He anticipated the modern ideas of atomism and the law of conservation of energy, put forward a consistent geological theory of the origin of the earth and gave an adequate interpretation of the origin of coal and amber. He laid down a programme of scientific investigation of the resources of Russia which, according to his biographer, has not yet been finished.

**Pre-revolutionary Russia & Science**

The rise of Russian men of science was not welcomed by the foreign academicians and Lomonosov is said to have remarked that those who wished to suppress the growth of Peter's plantations were enemies of Russian science.

The second period, according to Komarov, covered nearly the whole of the 19th century and it was one of the positive achievements in individual disciplines The Academy produced a number of Russian scientists of international reputation like Mendeleev, discoverer of periodic classification, Metchnikov, discoverer of white

corpuscles in blood, Pavlov, the physiologist, and others (see later) who enjoy international reputation and will be remembered as long as science lasts. But they had almost no influence on the Tsarist Government, though many of them felt keenly the backwardness of Russia in science and industry compared to other countries of Europe. In fact, geologists Karpinsky and Vernadsky, had been proposing to the Tsarist Government, even before the War, a grand scale survey of the mineralogical resources of Russia, as a prelude to her full-scale development, but the Tsarist officers had no more respect for Russian men of science than India Government officials or Indian politicians have for Indian men of science at the present moment. The Tsarist Government thus walked unwittingly to its doom.

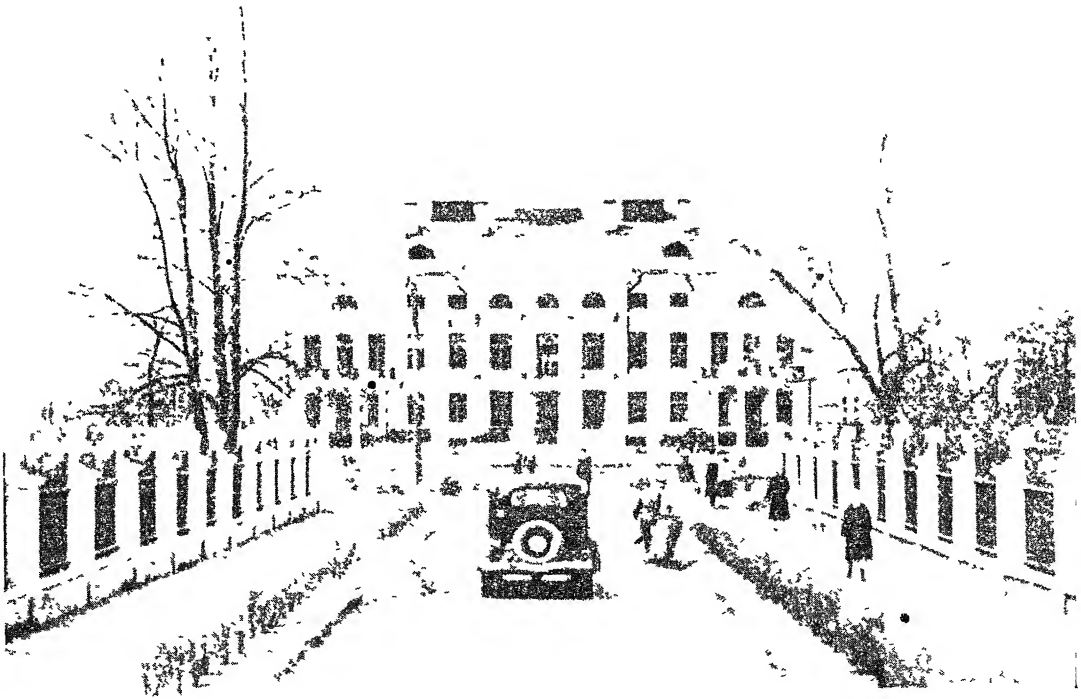
The Academy was like any one of the learned bodies in the West, like the Royal Society or the Academy of Sciences in France, a club of learned men and scholars, devoted to the pursuit of science, who met periodically to discuss the results of their researches and publish them for the use of the scientific world

**Revolution of 1917 A New Epoch**

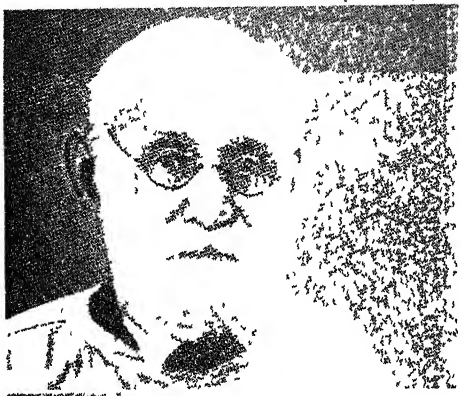
The Academy entered on a new epoch after the Revolution of 1917. Let us put the background of these reforms in the words of President Komarov himself :—

> *"The present time is one of unversal penetration of science into the life of man. Ours is a century when the tools of industry, social reforms and even Nature itself are remodelled on the principles of reason and science".*

The deep significance of these remarks is now realised all over the world, even in backward Latin America and China, except amongst the Khaddarites and the communalistic fanatics of India. But that was not so on the outbreak of the first World War when



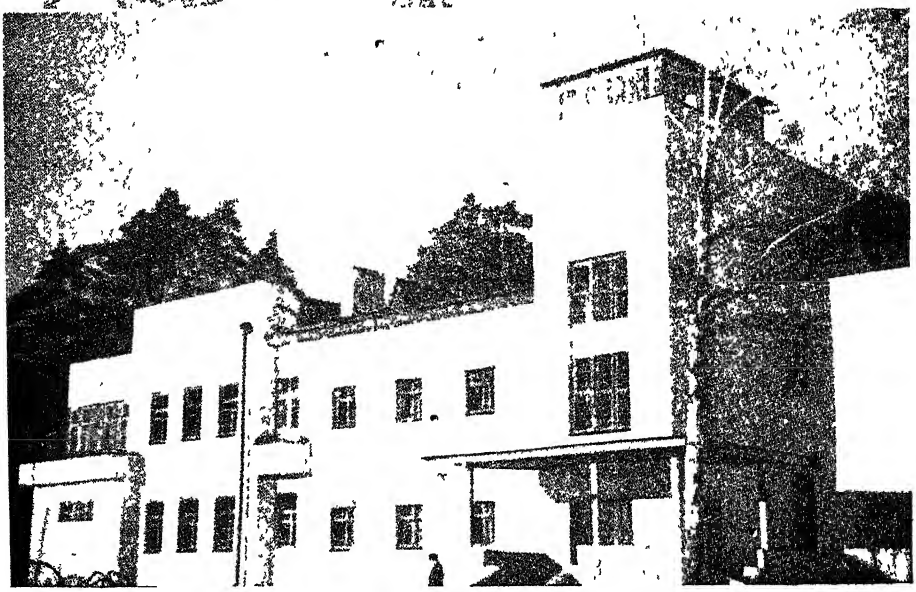
The Academy of Sciences of the U S S R in Moscow



*Above* The Second Scientific meeting of Pavlov year. From left were Pavlov's lived and worked

*Left* Ivan Pavlov the great Russian physiologist

*Below* The laboratory where Pavlov worked on his famous 'conditioned reflex' experiment



Academician Komarov with some of the guests to the Session

ACADEMICIAN SERGEI KHRISTIANOVICH

Leading specialist in the field of theoretical and applied mechanics. Conducted important research on thermodynamics, the theory of long waves and unsteady flow in canals and rivers, and the theory of plasticity. Awarded the Order of Lenin and a Stalin Prize.

ACADEMICIAN IVAN VINOGRADOV

Outstanding mathematician, known for his new theory of numbers and his solution of the Goldbach problem. Foreign Fellow of the Royal Society and Honorary Member of the London Mathematical Society. Awarded a Stalin Prize.

ACADEMICIAN VLADIMIR KOMAROV

President of the Academy of Sciences of the U S S R Chairman of the Commission for the Study of Productive Forces, the All Union Botanical Society and the All-Russian Society for the Conservation of Natural Resources Head of the Botanical Department of Leningrad University

ACADEMICIAN PETER KAPITSA

Director of the Institute of Physical Problems of the Academy of Sciences From 1921 to 1935 worked at the Cavendish Laboratory, Cambridge Twice awarded Stalin Prize for work on low temperature liquefaction of air and the properties of liquid helium Decorated with the Order of Lenin Fellow of the Royal Society

ACADEMICIAN ABRAM JOFFE

Vice President of the Academy of Sciences of the U S S R Director of the Leningrad Physico Technical Institute Known for his researches in the field of electrical semiconductors, the results of which were published in his work "Semi-conductors in Physics and Technology" Author of "Lectures on Molecular Physics," "A Course of Physics" and "The Physics of Crystals"

ACADEMICIAN LEON ORBELI

Vice-President of the Academy of Sciences of the U S S R Leading physiologist, initiator of the theory of evolutionary physiology Distinguished for his researches into problems of pain, the functioning of the kidneys, and the action of the sense and digestive organs

ACADEMICIAN NIKOLI BRUEVICH

Secretary of the Academy of Sciences of the USSR Specialist in mechanics Has done extensive work on aircraft engines and stationary engines Major-General in the Red Air Force

ACADEMICIAN ABRAM ALIKHANOV

Authority on the physics of X-rays and X-ray analysis Provided a basis for the modern theory of interaction between hard gamma rays and matter With Alikhanyan studied so called "Beta disintegration" Awarded a Stalin Prize for work on the physics of the atomic nucleus

ACADEMICIAN DMITRI BELYANKIN

Leading petrographer, specialising in the study of non metallic mineral products Contributed much to the war-time development of the Urals

ACADEMICIAN SERGEI SMIRNOV

Authority on mineral ores, particularly rare metals Author of many works on the mineralogy of Eastern Siberia, particularly the iron ore, lead and zinc deposits Founder of a school for explorers of rare metal deposits at the Leningrad Mining Institute.

even England and America were notoriously behind Germany in scientific organiation and industry. It was the lesson of the first World War, and the constant hammering by her scientists which roused England towards a full sense of her responsibility towards science, and compelled her to undertake a series of organisational measures which served her well in the second World War.

**Lenin** But Soviet Russia was more lucky She had at the end of the first World War as her ruler a man who was not only a great and successful leader, but one who had utilized his long period of exile in Western Europe in a deep study of science and technics and had realised, *as no other ruler or politician had ever done*, their influence on society and on the course of human history. It was not, as in bourgeois countries that the scientist had to hammer into the brains of rulers or politicians lessons about the usefulness of science to society but that the rulers of the country on their own initiative asked the scientists to come to their aid, even, as it happened, at the sacrifice of their careers as workers on fundamental problems of science.

After the Revolution of 1918, Lenin himself conceived the grand role which science was destinued to play if the Soviet system of life and government were to be a success. He saw clearly that old Russia was a hundred years behind times as regards economic development and if Soviet Russia were to survive in the midst of a hostile world, it should be transformed on the basis of science and technology into a great power built upon socialistic industry, collective ownership and management of land, and complete electrification of the country

She was to jump off, as it were, these hundred years of backwardness, in the course of ten or fifteen years. These thoughts were at the background of the Gosplan, or the National Planning Commission and the various Five-Year Plans which they formulated.

**A New Orientation**

As a vital link in this gigantic programme of reconstruction of Soviet Russia, Lenin, and after him Stalin, called the Academy to their aid, and enormously expanded its activity. The result of this expansion may be easily gathered from the following figures: In 1917, the Academy had 40 academicians and employed 212 scientists and technicians. It had 5 laboratories, 5 museums, 1 institute and 2 observatories under its control and organised 15 commissions for survey and field work.

In 1941, the Academy had 76 scientific institutes under its control, of which 47 were central, 29 under branches of the Academy, 11 independent laboratories, 42 seismological, biological and other stations, 6 observatories, and employed 5,000 scientists and technicians. Its budget in 1941 was 135 million roubles, plus 31 millions allotted from republican and local budgets for the maintenance of the various branches of the Academy. The work of the Academy requires the closest contact, with the Supreme Council of People's Commissars. In order to achieve this the headquarters of the Academy were removed to Moscow in 1934. There is a tendency to concentrate the main institutes in Moscow, not only because it is the Metropolis, but also because it has a central position. But the original Academy at Leningrad is being maintained as a branch, and the research institutes there are also increasing.

Since the Academy has such a close contact with the Central Government, it must not be supposed that it is merely an advisory body. The People's Commissars define the policy, but its execution and administration are left to the Academy as a whole. The scientists are not treated, as in this country, like the poor relations of a rich man to be kept at the outhouse, and occasionally called to the table for advice, but are given wide powers of administration, exploration and survey according to the central policy, as is evident from the large amount of finance which they handle.

**The Greatest Power In the Making**

The geologist Karpinsky who had vainly tried to rouse the Tsarist Government to the necessity of spending a few hundred thousand roubles for a better mineralogical survey of Russia, had the satisfaction of seeing nearly 10,000 geologists and mineralogists employed for this work by Soviet Russia He had also the satisfaction, as President of the Academy (1917-1936), to take the chief part in the organisation and supervision of this great work. The work excited the admiration of our British and American colleagues and I was particularly asked by Sir Thomas Holland, who was with us, and had been Director of Geological Survey for long years in India, to visit the Mineralogical Museum in Moscow, which, he said, was the finest of its kind in the world. They have a fine collection of all kinds of minerals and geological specimens gathered from various parts of the U.S S.R , which is a solid and compact bloc of land mass covering 1/7 of the total land surface of the earth, and large bands of workers are working on them I was thankful to Sir Thomas Holland, for though I am not a geologist, I immensely enjoyed my three hours' stay at the Mineralogical Museum in Moscow. The Museum contains a huge geological map of Russia, which shows the find-spots of minerals of economic value, and indicates to some extent their quality From these and the exhibits in the Museum, one has a realistic picture of the vast potential wealth of Russia The Soviets have so far developed only a small fraction of this wealth, but even this has given them an accession of strength which has excited the admiration of friend and foe alike When Russia is able to develop her resources fully, she will easily become the greatest Power in the world

**Other Institutions**

It must not be supposed however that the Academy monopolizes all scientific research. In Soviet Russia there are no private industrialists; all heavy industries, public health, transport, land reclamation, river control, and

the rest are State monopolies and are under the People's Commissars Every one of the industries and subjects has research institutes of its own, and every big factory, which is of course State-owned has research laboratories of its own The researches carried out in these institutes are mainly practical. With a view to promoting medical research, the Council of People's Commissars decided to found an Academy of Medical Sciences of the U S.S.R. attached to the Commissariat of Health of the U S.S.R.

The principal function of the U S S.R Academy of Sciences, according to its own memorandum of associations, is to promote the general development of both theoretical and applied sciences in the U.S.S.R., and the study and development of the achievements of world science. The Academy bases its work on the planned utilization of scientific achievements for the purpose of promoting the building up of a new classless society.

But mention must also be made of scientific researches of a fundamental character carried on in the Universities and Colleges In 1917, Russia had 91 Universities and Colleges, and 289 research institutes under them. In 1939, the number of Universities and Colleges had grown to 700, the research institutes of Universities to 906, and 26,246 scientists are employed there

In the words of Peter Kapitza:

*"The Academy of Sciences is the G.H.Q. of Soviet Science. It is called upon to be the ideological guide of the whole of Soviet Science, from top to bottom, to direct it along a healthy channel. Each individual institute of the Academy of Sciences must follow the same policy, i.e., strive to become the guiding influence in its particular sphere of science and try to achieve its maximum development."*

**Glorious Achievement**

President Komarov dwells upon some of the achievements of the Academy in individual fields:—

"The third period has seen the discovery of superfluidity in helium by Kapitza; our chemists are proud of the theory of physico-chemical analysis developed by Kurnakov, of the works of Zelinsky, Favorsky and others. Remarkable biochemical ideas have been developed by Bach. Mechanics and mathematics have received valuable contributions at the hands of Krylov and Vinogradov. The study of the Earth's crust has been substantially advanced by the investigations of Obruchev. In physiology important work has been done by the pupils of Pavlov headed by Orbeli.

"The power of the Academy of Sciences of the U.S.S.R. as the scientific centre of the Union became conspicuous during this great national war against the German invaders. With the country, with the whole body of scientists, Academy put all its strength into the defence of the Fatherland and had substantially contributed to the defeat of the enemy.

"A feature characterising the development of science during the third period is that the 'complex' method was used in working out scientific problems. As an example of such 'complex' way of treatment, the President refers to the work of the Committee on the Mobilization of the Urals' resources, of which he has been the head.

"The Committee, says he, has worked out the most urgent methods to be undertaken in ferrous and non-ferrous metallurgy, power engineering, transport, manufacture of building materials, and agriculture. During the 50 years that I have been working as a scientist I have never felt so completely satisfied as since I have been given the opportunity to work at the mobilization of the inexhaustible resources of this great country of ours. Never have I seen our scientists work with such enthusiasm. All fields of Soviet science have been involved. The physicists were occupied with the theoretical and experimental work aimed at the construction of new types of armament; mathematicians

have worked out new rapid methods of calculation for artillery, aircraft and men-of-war; chemists have developed new processes for producing explosives, alloys, pharmaceutical substances, biologists discovered additional food resources for the Red Army and the population, and many thousand of lives of our Red Army men so precious to us have been preserved, thanks to the new methods of war medicine worked out by our scientists. We feel proud of the idea that our work has been helpful in some way to the Army and Navy which have given so good an account of themselves in the anti-Fascist war."

**Greetings from the Communist Party** The contributions made by the Academy to the National Defence were acknowledged in the following message sent by the Council of People's Commissars of the U.S S.R. and the Central Committee of the Communist Party of the Soviet Union (Bolsheviks) to the Academy, on the occasion of its 220th anniversary —

"The Academy of Sciences of the U. S S. R. is observing its jubilee at a time when the Soviet people have victoriously brought the Great Patriotic War against the German invaders to its termination. During the war, Soviet scientists conducted successful work, rendering aid to the front and the national economy of our country by their labour. Soviet scientists made a valuable investment in the defeat of the enemy. Soviet scientists, physicists and chemists, mathematicians and astronomers, biologists and medical men, geologists and geographers, historians and philosophers, law scholars and philologists, are working fruitfully in the institutes of the Academy of Sciences.

"Our science has given the world great men. The Soviet people are rightfully proud of Lomonosov, the founder of Russian science; Mendeleev, the brilliant chemist; Lobachevsky, Shebyshev and Lyapunov, the great mathematicians, Karpinsky, one of the greatest of geologists; Przhevalsky, the world-renowned geographer;

Pirogov, the founder of military field surgery; Mechnikov, Sechenov, Timiryazev and Pavlov, great trail blazers in biology, Michurin, the remarkable transformer of nature; Lebedev, the able experimenter in physics, Popov, the inventor of wireless communication; Zhukovsky and Chaplygin, the authors of the theory of modern aviation; Belinsky, Dobrolyubov and Chernyshevsky, the eminent thinkers who advanced Russian revolutionary thought, and Plekhanov, the great pioneer of Marxism in our country.

"The Soviet people are proud that they gave the world the greatest genius of our epoch, that coryphaeus of progressive scientific thought, who enriched Marxism and advanced it far ahead in keeping with the new conditions of development, the author of the theory of the transformation of modern society into a Socialist society on the basis of the Soviet system, the founder of our Soviet State— Lenin.

"By their discoveries, inventions and researches the scientists of our country have made an inestimable investment in the development of world science and of society.

"Soviet scientists have achieved great results in many provinces of science and engineering. Yet all men of science must always remember that there are still many problems of science and engineering that have become ripe for solution but that have not yet been solved, and to solve which Soviet scientists must work intensively. The Soviet people expect of their scientists the successful solution of the tasks life has placed before our science.

"The Council of People's Commissars of the U.S.S.R. and Central Committee of the Communist Party of the Soviet Union (Bolsheviks) express their confidence that in its future activity as well the Academy of Sciences of the U.S.S.R. will develop further the best traditions of our domestic and world science, make every use of its achievements to develop the economy and culture of the peoples of the U.S.S.R., and raise still higher the prestige of Soviet science amongst the nations of the world."

# IV

# A Free People and Science Transform a Country

THE STATE PLANNING Commission ( Gosplan ) is the mainspring of the whole national economy of the U S S.R It had been created as early as 1921 in pursuance of the fundamental creed of the Bolsheviks that the State should take the lead in all economic matters and that all means of production and distribution should be socialised. The State Planning Commission has issued the Goelo Plan (1921-1928), the first five-year plan (1928-1933), and the second five-year plan (1933-38). On the completion of the second it issued the third five-year plan, but was only half way through it, when the War broke out.

Every five-year plan aims at a definite target of production; the objective is defined by the Council of People's Commissars, but it is the State Planning Commission which devises the ways and means of reaching the target. In making these plans, the State Planning Commission acts in close co-operation with the Academy of Sciences which may be said to form one of its important brain centres.

In what way does the Academy help the Gosplan? A description of my visit to the Institute of Energetics may bring out the points clearly.

The Institute of Energetics is housed in a large building in Moscow, which appeared once to have been

a grand ducal palace (though I am not quite sure of that) opposite the Academy of Sciences. It is named after Academician G. M. Krzizhanovsky who was President of the Committee of Energetics formed in 1920, and director, when the Institute was finally organised in 1929. In Russia it is the custom to name an institute in honour of very distinguished and successful directors, e.g., the Botanical Institute at Leningrad is named after V. L. Komarov, once its director and now President of the Academy. Not every director is, however, so honoured.

**Institute of Energetics**

The Institute of Energetics is a research institution of a very unconventional type. It is difficult to find out its counterpart outside Soviet Russia, though there may be in other countries quite a number of institutions which, taken together, discharge the same function. Soviet Russia has other institutions of an unconventional type. The Bolsheviks are not slavish imitators of old systems, and never hesitate to strike out bold innovations whenever the interest of a particular cause demands such initiative.

Now, what was the background which led to the foundation of the *Institute of Energetics,* and what role does it play in the national economy of Russia?

Today people have not to be told of the importance of correctly assessing and taking measures to increase the productive power of a country. The victory of the Allies in the World War was mainly due to the far larger productive power of the Allied countries over that of the Fascist countries. It was nearly four to five times higher. The U.S.A. alone has larger, nay, probably one and a half times of the productive power of the rest of the world put together. When the Fascist countries put in one aeroplane, or one tank, the Allies could put six to eight. It is the huge productive power of the Allies which had overwhelmed the Fascist countries.

**National Income** In peace time the productive power goes to increase the general prosperity, or what we call the National income of a country. Divide the total National Income by the population of a country and you get the average per capita income. It was 8,000 million pounds in Britain for 46 million of its inhabitants before the War, or 170 pounds per head or Rs. 2,200. During the War, according to a PEP report, it has increased to 10,000 million pounds or Rs 2,750. In India according to the National Planning Committee the per capita income was Rs. 65 before the War. Now it may be larger, if reckoned in rupees, but as the purchasing power of the rupee has diminished nearly 3 times, the national productive power has not at all increased. The money index is therefore not suitable for calculating national prosperity.

**Energy Index,** Can we devise a method of correctly assessing the productive power of a country? All productive work used to be done either by hand, or by animal labour in medieval times, but now most work is done by machines driven by electricity, steam or petrol. These agencies produce 'Energy' and energy becomes productive work. If we have data for the production of total energy of a country, we can have a fairly accurate measure of the productive power of a country. I say "fairly accurate," because actually other factors should also be taken into account.

If we divide the total energy output in the year from electricity, coal, fuel, man-power, etc., by the whole population of a country, it gives us a quantity which we may call the "energy index" for that country. The energy index gives us a measure of the comparative prosperity of the country. The energy index in medieval times could not be more than 90 in any country. Almost all the energy was from "human or animal labour" and this was the limit of energy production from a medieval system before the Industrial Revolution. In modern countries it has risen to very large figures: in the U.S.A. it probably now exceeds 3,000, due to its

enormous development by hydro-electric power and power from coal and petrol. In England and advanced West European countries it is not more than 2,000. In India it cannot be more than 120 (and in China not more than 100), because we have not developed our hydro-power and use only 30 million tons of coal per year, while the U.S.A. uses 600 million tons for 1/5 the population. This explains why the average Indian has only 1/30th of the income of the American or 1/20th of the income of the European.

**Medieval Economics**

These figures show also the fallacy of the Gandhian economists who believe they can bring about a new Kingdom of Heaven by following "medieval economics". Altruism (the philosophy of doing good to all men) preached by all great religions could not be a practical proposition before the days of Science, because sufficient goods could not be produced to give plenty for all. Society would have to consist, in one form or other, of lords and serfs.

We began thinking in these terms in India only in recent years. But Lenin, following the line of thought chalked out by Marx and Engels, had been thinking in these terms since 1900. In 1913 he wrote:

> *"Russia is still an incredibly backward country —backward to an unheard of degree, poor and semi-barbarian, which, in equipment of modern instruments of production, is four times worse off than England, five times worse off than Germany and ten times worse off than America"*

In pointing this out Lenin made a scathing attack on the capitalists and landlords who were in power in Russia, because "by their oppression" they were "condemning five-sixths of the population to beggary and the whole country to stagnation and decay."

**Pre-Revolution Backwardness** Lenin thought in 1913 in terms of electricity, coal, oil and iron Describing conditions in 1913, Molotov quotes from Lenin :—

"What was the level of industry at that time in Russia?

"The per capita output of electric power in 1913 was one-seventeenth of the output in the U.S.A. and one-fifth of the output in Germany.

"The per capita output of *pig iron* in 1913 was one-eleventh of the output in the U.S.A., one-eighth of the output in Great Britain, one-fifteenth of the output in France.

"The per capita output of *steel* in 1913 was one-eleventh of the output in the U.S.A., one-eighth of the output in Germany, one-sixth of the output in Great Britain and one-fourth of the output in France.

"The per capita output of *coal* and *lignite* (in terms of coal) in our country in 1913 was one-twenty-sixth of the output in the U.S.A., one-thirty-first of the output on Great Britain, one-fifteenth of the output in Germany and one-fifth of the output in France.

"That is how low the level of Russian industry was before the Revolution. The landlords and capitalists who ruled the country used the iron hand of Tsarism to shackle the mighty forces of our people and gave them no opportunity to develop

"Especially noteworthy is the fact that Russia at that time, far from overtaking the most highly-developed capitalist countries, was, on the contrary, falling further and further 'behind' them in a number of major industries."

Conditions became worse until the period when the Bolsheviks took power.

"The power equipment of Russia in the pre-war period was largely paralyzed or destroyed during the World War and the civil war. The output of stations of the Moscow system dropped in 1920 to 93 million units—one-fourth that of Calcutta of present times, though Moscow was double in size—compared to 171 million units in 1916. The total electricity output for Russia in 1920 fell to 500 million units, i.e., about one-quarter of the output of pre-war Russia. The coal output in 1920 was 8.5 million tons which is 29.4 percent of the 1913 figures, and the output of iron ore and smelting of iron and steel fell to 2.5 percent of 1913."

**Lenin's Vision**

"During these years of World War and civil war instigated by the bourgeois countries, Lenin put forward the historic programme for the restoration and reconstruction of Russia's national economy on new socialistic foundations on the basis of the most advanced technique, viz., electrification

"In 1918 when the country was ablaze with the fires of civil war, Lenin requested the Russian Academy of Sciences to begin the scientific and technical study of reorganising industry and effecting the economic recovery of Russia. He emphasized the necessity of 'paying especial attention to the electrification of industry and transport and to the employment of electricity in agriculture'.

"In 1920, a committee consisting of two hundred scientists and engineers, headed by Professor Krzizhanovsky, was appointed for elaborating the plan of governmental electrification of Russia (Goelro plan). This plan was projected for 10 to 15 years, and it provided for a capital investment of 17 billion roubles (about 2,500 crores of rupees) and aimed at an industrial production rise of 180 percent to 200 percent of the pre-war level.

"*Regarding this plan Lenin wrote in* 1920 *that 'a report on the electrification of Russia had been in-*

*cluded in the agenda of the Congress of Soviets, so that the single economic plan for the restoration of national economy that we have been discussing may be outlined from the technical standpoint. Unless Russia is placed on a different technical level, higher than before, restoration of the national economy and communism are out of question. Communism is Soviet power plus the electrification of the whole country, for without electrification progress in industry is impossible."*

The achievements of the successive five year plans are now known all over the world. The figures given by Russians have been doubted in some quarters, but victory against the Nazi hordes dispelled all these doubts, because 90 percent of the materials used against the Nazis were manufactured in Russia itself. But let us quote some figures.

**Transformation under Bolshevism**

In 1939, Russia produced
50,000 million units of electrical energy,
150 million tons of coal,
35 million tons of petroleum,

and showed proportionate increases in all agricultural and industrial products. Her energy index had risen to clearly over 1,000. This is no mean achievement from a figure of 120 in 1918. The composition of her people in 1928 and 1937 was as follows —

| | 1928 | 1937 |
|---|---|---|
| Workers and employees | 17 | 33 |
| Collective and co operative farmers | 8 | 55 |
| Individual peasants tilling small plots | 73 | 6 |
| Capitalists | 5 | — |
| Miscellaneous | 2 | 4 |

Literacy has increased from 12 percent in 1918 to 94 percent in 1943.

The Bolsheviks have thus transformed the country from a collection of illiterate peasants and serfs, dominated by foreign capitalists, chinovniks (civil servants), clergy, landlords and merchants, into a classless society of scientists, industrial workers and collective farmers. The Tsars hurled against the highly-trained Germans bands of illiterate peasants and serfs and perished. Stalin hurled an army of technically skilled men with plenty of weapons and war materials and saved the country.

**Brain-Centre of Planning**

In drawing up plans for electrification, the Committee of Energetics working under Krzizhanovsky played a great part. In 1929, the Institute of Energetics was founded to carry on the work of the Committee, as the brain-centre for the development of Russia's energy sources. The field of survey of minerals, essential for industrialisation was carried out on a grand scale and collated by about 8 geological and mineralogical research institutes under the Academy. For the hydrographic survey of rivers, which is essential for the development of rivers for a great many purposes, 5,200 river stations were opened, and data correlated in the Laboratory for Hydrological Problems in Moscow and at other places The actual development of power stations was carried out by departments under the State Planning Commission, but the Institute plays the vital part of acting as the brain of the chain of organisations. Space and limitation of knowledge alone forbid me to speak of the great work done in soil science, agriculture and medicine

*The Bolsheviks planned like giants and finished like Titans.*

**Russia and India**

I found Prof Krzizhanovsky to be an old man of 74, but quite hale and hearty like Father William in the well-known poem.

After an unsuccessful attempt to exchange thoughts in English and French, we started in German which the Professor spoke fluently He had apparently undergone German education in his student days, though I did not put that question to him . The Professor wanted information about the productive power of India. I said:

"*We produce about 3500 million units of electrical energy, i.e., about 9 units per head; about 30 million tons of coal, two and a half million tons of iron and steel, and produce no petroleum at all.*"

"Is that all?" said Krizhanovky, "Then you are as bad as Russia was in 1918 We then produced 2000 million units of electrical energy for the whole of Russia, which had fallen to 500 millions in 1920, i.e . only 5 units per head. We produced just half of tiny Switzerland Our coal production was worse than yours, though having Baku, we produced quite a lot of petroleum, but the industry was dominated by foreign capitalists and only nominally belonged to Russia."

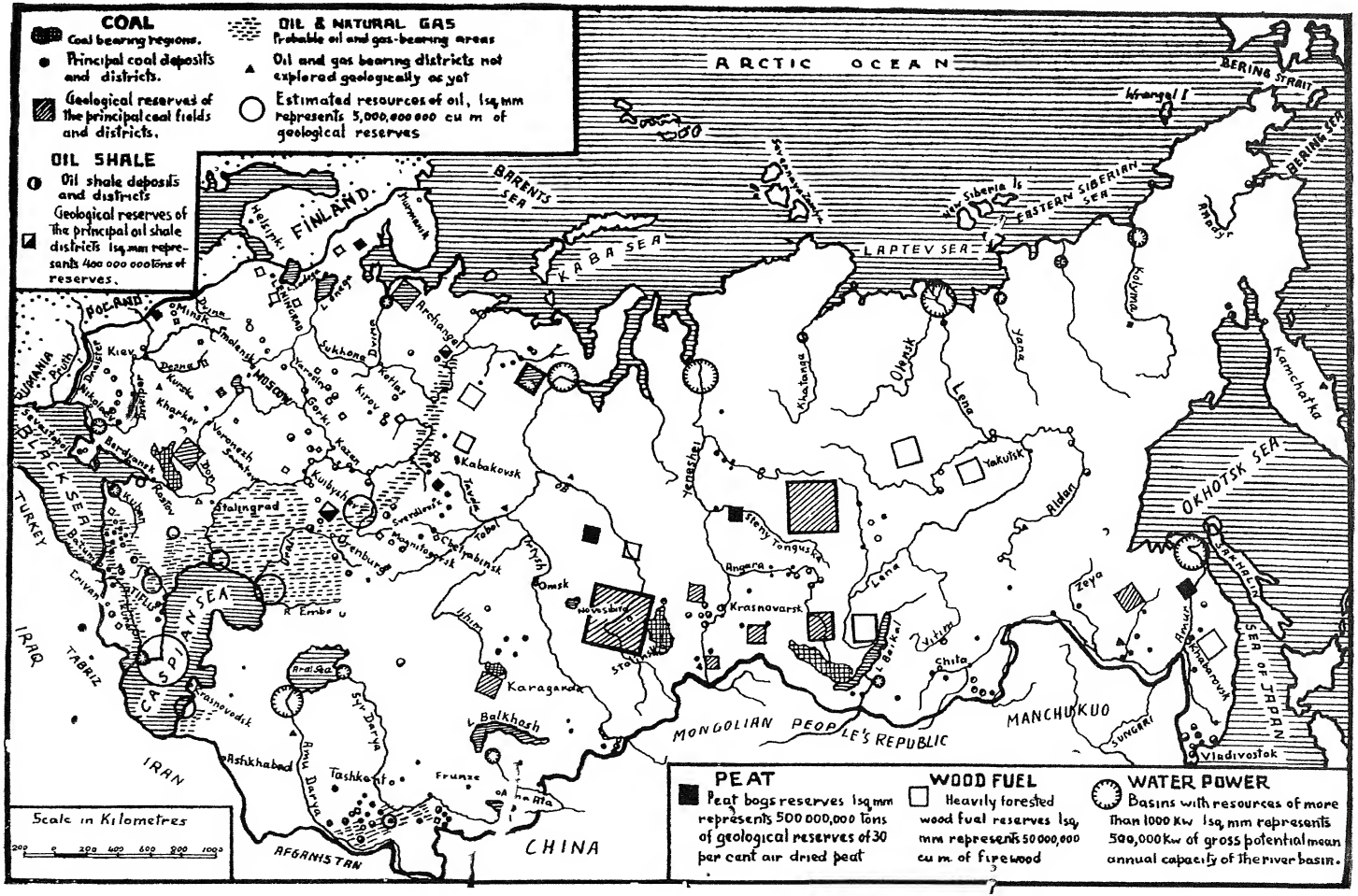
"*What is your production now?*" *I enquired.*

"We have not yet been able to collect reliable statistics on account of the War, but in 1939 just before the outbreak of the War we were producing 50,000 million units of electrical energy from fuel and hydro-electric power, i.e., about 300 units per head of our population We have been producing 150 million tons of coal and peat, 30 million tons of petroleum, 20 millions of iron and steel According to the third five-year plan. we would have produced 75,000 million units of electricity in 1942, i.e., nearly 450 units per head, and coal, petroleum and iron in corresponding proportions. But the War has caused a lot of destruction, though we have developed many new centres. Exact statistics are being compiled."

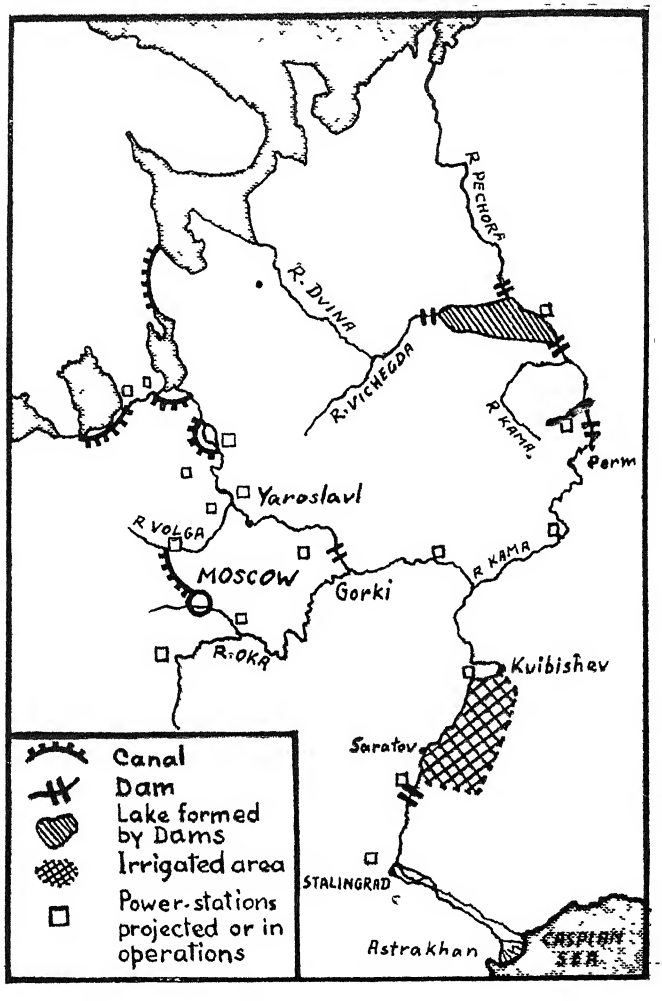
**Russia and America**

"But you are then still far behind the United States of America in energy

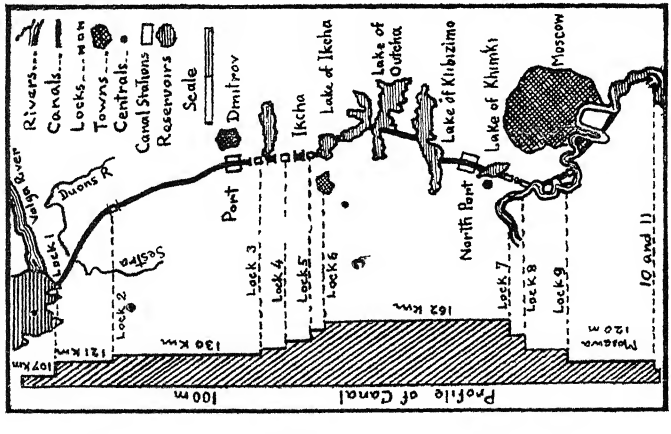

Map of Iran and Iraq showing a part of the Soviet Union and the Middle East Countries.




A map of the Soviet Union showing her power resources



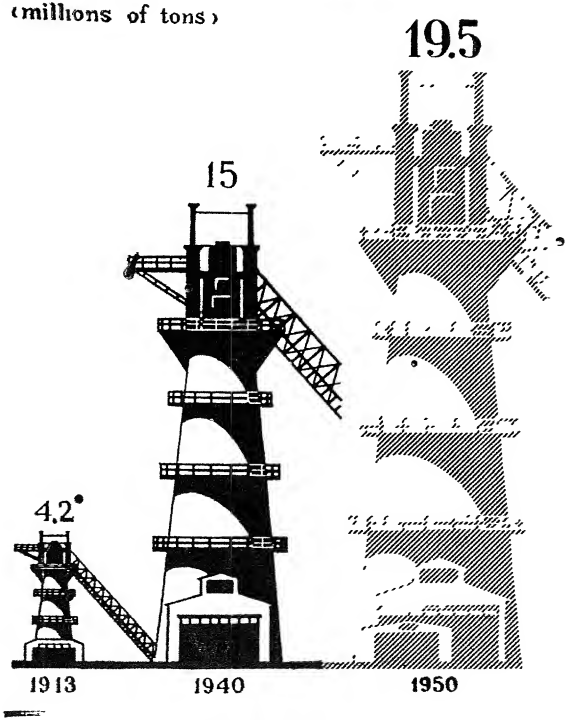

The Great Volga-Scheme




Moscow—Volga Canal.

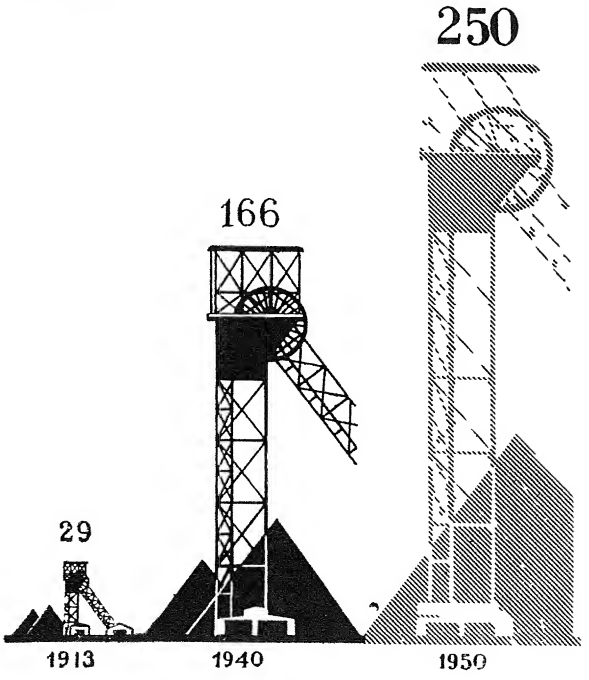
# PIG IRON PRODUCTION

(millions of tons)



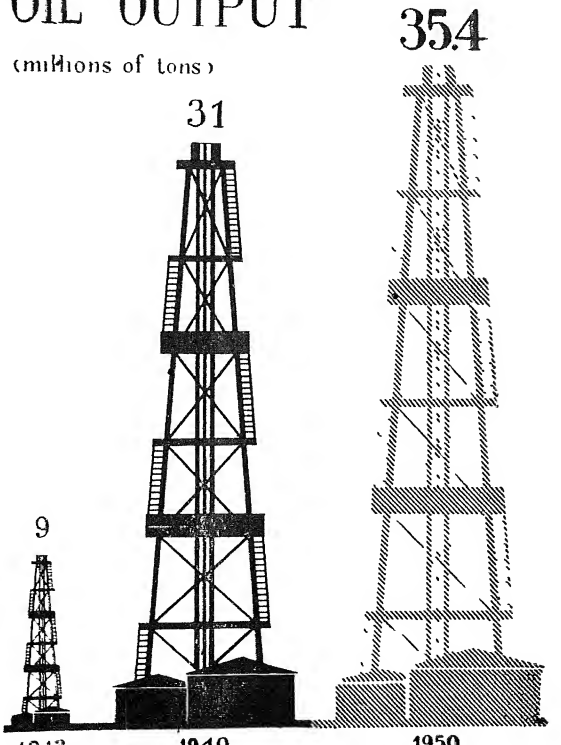

# COAL OUTPUT

(millions of tons)



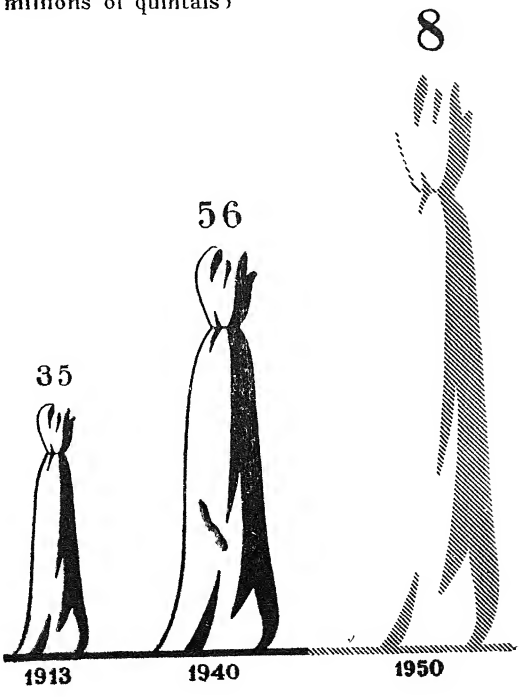
# OIL OUTPUT

(millions of tons)



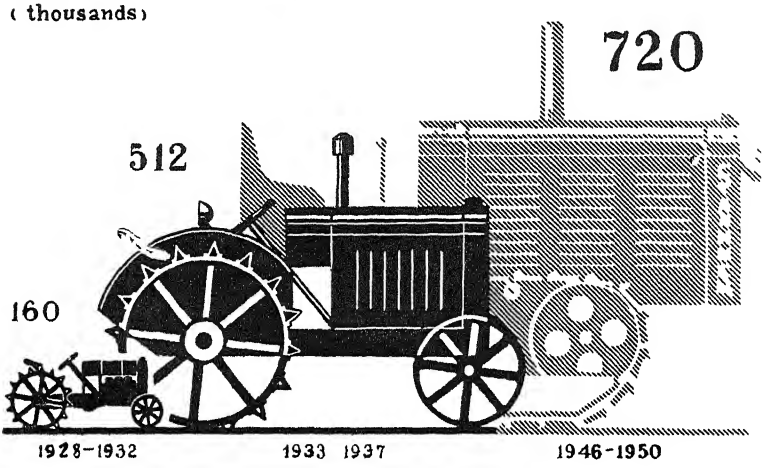

# GROSS OUTPUT OF FLAX

(millions of quintals)



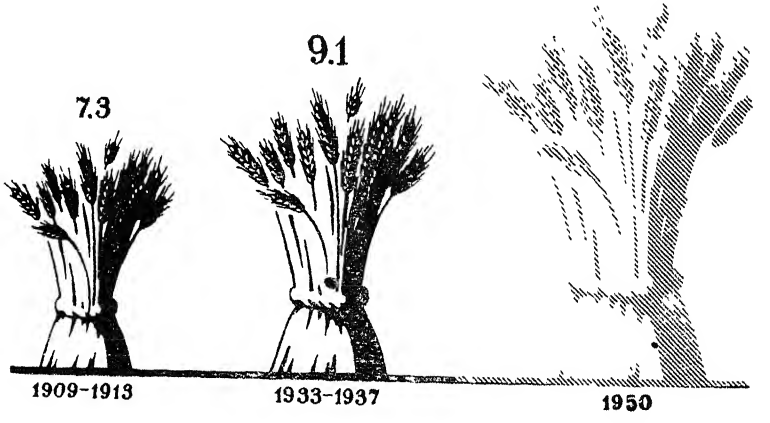
# PRODUCTION OF TRACTORS

( thousands )



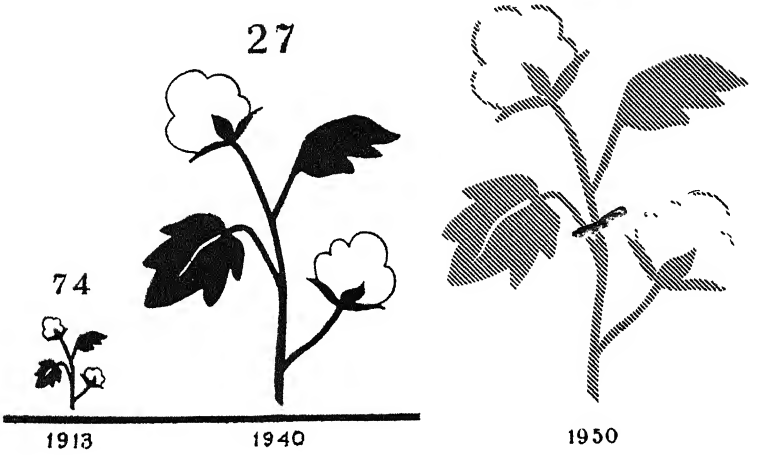

# INCREASE IN THE GRAIN CROP-YIELD

( in quintals per hectare )



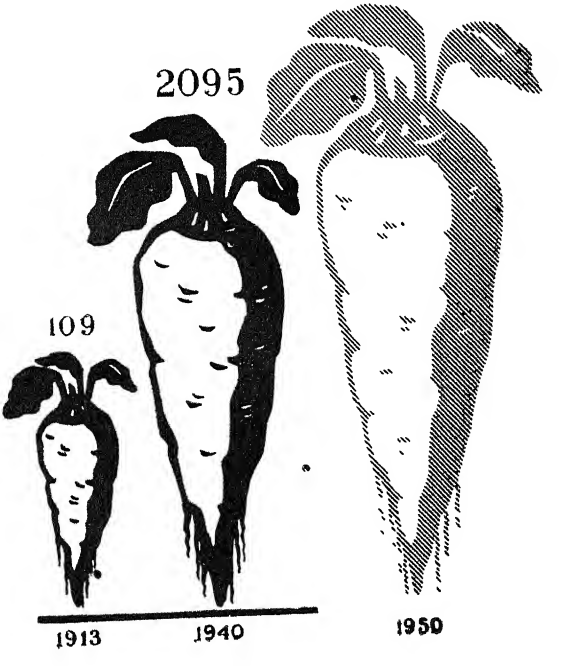
# GROSS OUTPUT OF COTTON

(millions of quintals)




# GROSS OUTPUT OF SUGARBEETS

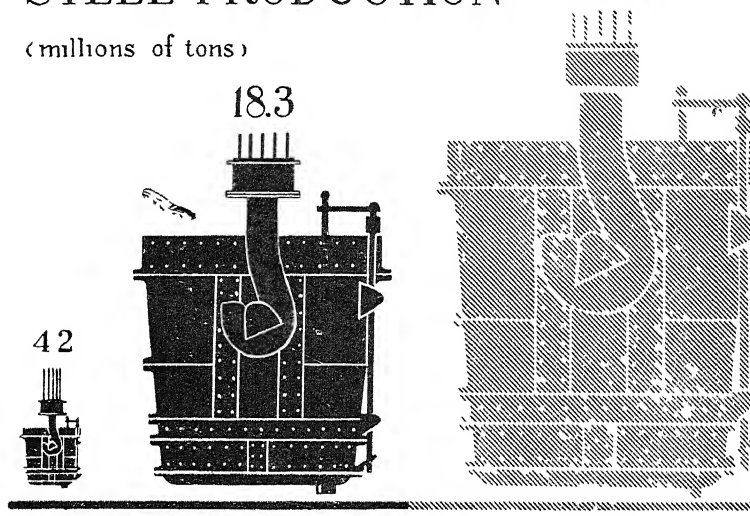
(millions of quintals)



# THE FOURTH FIVE-YEAR PLAN OF THE U. S. S. R. THROUGH PICTURES

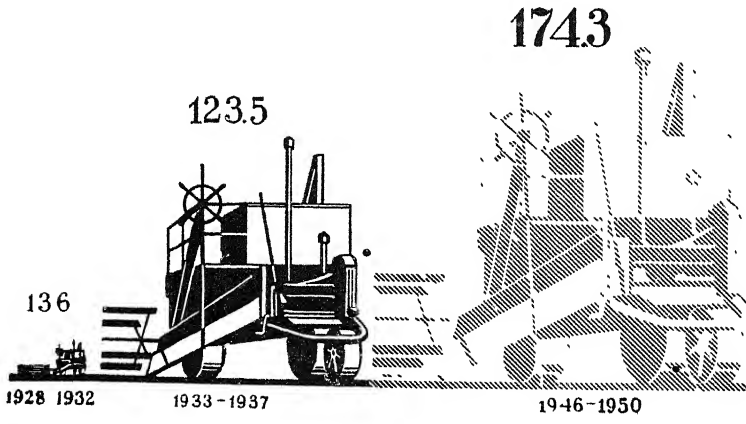
## STEEL PRODUCTION

(millions of tons)




## PRODUCTION OF HARVESTER COMBINES

(thousands)



production, and hence in productive power", I remarked.

"Yes, that is so at the present moment, but it will not be long before we overtake the U. S. A." Prof. Krzizhanovsky then took me to a room where the energy resources of Russia and other countries are displayed in a graphic way. Pointing to the figures, he said: "Look here, the U S.A. has total resources of 82 million kilowatts of hydro-power. We have 130 million kilowatts. We have larger coal deposits than the U.S.A., thanks to discoveries by our geologists in Siberia, and thanks to geophysical and geochemical prospecting work, we have discovered new petroleum resources which are far richer than those of the U.S.A. They have 4,400 million tons, we have 8,800 million tons of known reserves of petroleum. You have heard of the second Baku (Bashkira), I suppose. We have plans for producing two hundred million units of electrical energy, and larger amounts of petrol and coal than the U S A within the next ten years In the next twenty years we are sure to surpass the U.S.A in energy production and in productive power."

*"Provided there is no third world war," I mused, but did not say so openly.*

**Conditions in India**

Conversation then turned on conditions in India. Krzizhanovsky said: "From all accounts I have and all the information I have collected, I know that India is a country of enormous resources; it should be rich in hydro-electric power resources, minerals, and agricultural resources Why should then the people continue to be poor?"

*"You are quite right India is a country of enormous potential resources in power, minerals, and in agricultural raw materials, but the paradox is that her people are abominably poor"* But I said: *"Pre-revolutionary Russia had also great natural resources, but why were the people of Tsarist Russia as poor as those of India? Why, in your country, were 80 percent of the people peasants and 90 percent of them illiterate?"*

"That was so, because the Tsar and his advisers were stupid, the chinovniks (civil servants) were corrupt, and had a pathetic belief in foreign scientists and technicians. They would always call for foreign experts' advice, who would tell them that Russia had no resources, and her people could not be engineers or artisans, but only peasants and civil servants, and would not listen to the pleas of Russian men of science like Mendeleev and Karpinsky that Russia could be strong like the countries of Western Europe only if her natural resources were fully developed. They would not even spend a few hundred thousand roubles on mineral and hydrological survey."

*"We still have our Tsars" I added "They are not stupid but extremely clever, but they have no incentive to develop the resources of India except for their own benefit."*

"The first step is to get rid of your Tsars, but that is not all You must not have a Kerensky, but a Lenin to guide you," said Krzizhanovsky

*"Some say the Tsars have expressed a desire to go into voluntary liquidation, provided they can find out Indians with brains enough to take over the administration from them," said I. "But we have no Lenin in sight, we have a Tolstoy and Pelituras (Ukrainian separatist) who claim to speak for the nation."*

"By Tolstoy you probably mean Gandhi and by Pelituras you mean the separationists. But they would not do in a modern world You must have a Lenin," emphasized Krzizhanovsky.

*"Why?" said I. "Your Government appears to be very appreciative of Tolstoy They have converted Yasnaya Polyana (the family seat of the Tolstoys) to a National Museum and encourage people particularly foreigners, to make a pilgrimage there to pay homage to the saintly virtues of the greatest of Russian writers"*

**Tolstoy and Gandhi**

"Tolstoy was a great writer and a great artist, but Soviet Russia appreciates him chiefly for this *War and Peace* where he describes in vivid language the patriotic war of the Russia of 1812 against the hordes of Napoleon. This work is an epic and has inspired the Russian people in their recent fight against the hordes of Nazi Germany, for you know that in spite of our efforts, we were somewhat behind Germany in production and fighting power. We would not have been saved but for Stalin's leardership and the patriotic rally of the Russian people round him. Tolstoy's *War and Peace* did play a great part. But Tolstoy's 'Sermon on the Mount' theory of Government is regarded as the product of a crazy brain, due to senility and want of acquaintance with the modern world"

Krzizhanovsky told me some funny stories about Tolstoy one of which were known to me. He did not believe in railways and thought he had proved their *uselessness* by walking on foot from Leningrad to Moscow. He did not carry any money with him, lest it should spoil his soul, but Countess Tolstoy kept his purse, supervised his large income from books and managed the household. He did not believe in medicine, but Countess Tolstoy put drugs in his drink. Krzizhanovsky said, "We have great and genuine respect for Tolstoy, the writer of Russia's epic struggle against the foreign aggressor But Russia has never taken his political and economic theories seriously"

**Gandhiji's Contribution**

*"I have also great respect," said I, "for Gandhiji who was inspired by the Tolstoyan philosophy, but unlike Tolstoy whose resistance against Tsarism was only passive, Gandhi made his philosophy into a militant creed against British Imperialism in India. He has succeeded better than our earlier nationalists, for it was he who made the struggle for independence a live issue for the common man of India."*

"But what about the spinning wheel and bullock-cart economics of Gandhi?" asked Krzizhanovsky. "Clearly when he and his party get power and put these economics into practice, India would never walk out of medievalism, which would be far worse than British Imperialism, as far as the lot of the common man is concerned. The spinning wheel uses human labour but you must be knowing that a man working for eight hours can produce work in the day which can be had only for 20 kopeks (3 pice in Indian money). We in Russia allow men to use either electrical energy or steam energy and every Russian worker does the work of seven or eight men That is how we have increased our productive power and met Germany on almost equal terms"

**National Planning Committee**

*"Myself and many of my brother scientists have as little regard for Gandhi's economical and social theories, as you have for Tolstoy's," said I, "and we have been putting forth the same arguments. You see that we were able to persuade the Congress High Command to set up a National Planning Committee with Gandhi's second in command, Jawarharlal Nehru, as Chairman He enlisted the co-operation of India's best scientists, economists, and industrialists, and our line of thought has evidently made some progress."*

"I have heard of Jawaharlal Nehru, and his National Planning Committee," he said. He mentioned some pamphlets he had seen. "Nehru is second in command to Gandhi, but does he also share Gandhi's economic ideas?"

This was a difficult question for me to answer, so I tried to bypass the question. *"What impressed me about Nehru and was a decisive factor in my desire to serve the National Planning Committee," I added, "was a little remark in one of his writings. Talking of 'Liberals,' a class of politicians in our country, who want to pursue a middle path, and thus satisfy every party like*

*your Menshevils and Kerensky, Nehru said, 'If you ask a Liberal whether the earth is round or flat, he will say neither the one nor the other, but after hesitation will say it is probably elliptical. He wants to satisfy both and commits blunders.''*

"If he said that", replied Krzizhanovsky, "he is just the right man to give a definite verdict against the spinning wheel and homespun of Gandhi. He may probably play the role of Lenin."

**Lenin's Role** *"What is the role of Lenin," I asked. "Can you elaborate that point a little?"*

"Lenin," said Krzizhanovsky "was not merely a professional plotter and successful revolutionary. He was a great student of history, economics, science and technics. He saw clearly that if Soviet Russia was to survive amidst a hostile world, she must acquire 'strength' like the U.S A. and the countries of Europe by a planned development of the country's resources, by complete electrification of the country, by the collective use of land and water, etc. His ideas have borne fruit and you are seeing the result to-day. Had he not this vision, Russia would have been a German colony in 1942 and the Ukrainian separationists would have perished in German concentration camps."

Prof. Krzizhanovsky then took me to the individual workers of the Institute. They were working on problems of long-distance transmission (for Russia sometimes transmits over 500 kilometers), over surge problems; over Papalexi generators (they were electrical motors and generators discovered by Academician Papalexi on a fundamentally novel principle), experiments on the direct conversion of sunlight to useful work (heliotechnics) and the design of new types of wind motor. But all the time, I was wondering whether India would be able to throw up a Lenin to guide her future, or whether she would be engulfed in the maelstorm of medieval ideologies

# V

# Triumphing Battle against Nature

THE ACADEMY OF SCIENCES arranged a number of interesting trips. An all-day visit to the Moscow-Volga Canal, a two-day visit to Yasnaya Polyana, home of Leo Tolstoy, and visits to a state farm and a collective farm, about 20 miles north of Moscow There are so many things to see in new Russia, and one feels that "Art is long, and Time is fleeting"

One batch, including my esteemed friend Sir Harold Spencer Jones, Astronomer Royal of England, took the trip to Yasnaya Polyana. Though the distance was a little over 100 miles, the trip took them two days, as the roads were very bad due to the war. They were received by a grand-daughter of Tolstoy and were shown, as Sir Harold told me, amongst other things, letters written by Mahatma Gandhi to the Russian sage, on various occasions.

**Moscow-Volga Trip**

The Moscow-Volga trip, which took place on June 21, was selected by the largest number of scientists. We had to motor to the northern port of Moscow known as the Khimky station about 10 kilometers from the Kremlin. We had to pass the Moscow Airport and motor some distance into the open country. This part of Moscow is rapidly expanding and the city is creeping almost to the Khimky River Port.

The Port Building, which is in the midst of a lovely garden, attracts one's attention even from some distance One writer describes it as "looking like a giant double-decker ocean liner with the captain's bridge in the middle. A five-pointed gold star glistens at the top

of its tall spire of stainless steel, rising 262 feet above the ground. The main entrance to the building is decorated with porcelain discs bearing sculptured representations of the Kremlin, the Palace of Soviets, the Lenin Mausoleum, the Theatre of the Red Army and the Dnieper Hydro-electric Station The porcelain discs on the land side depict a number of famous ships, such as the ice-breaker Krassin, the Soviet cruiser Aurora, Columbus' Caravel, etc "

**On Board the "Gorki"**

We boarded the fine river steamer " Gorki," having a displacement of 2,000 tons It was a new boat, scrupulously clean, provided with fine cabins, dining halls, and recreation rooms. Amongst my friends were Dr. Shapley, astronomer, Harvard University, Dr. Langmuir, Dr. and Mrs. Szent-Gyorgyi from Hungary, Professors Joliot-Curie and Irene Joliot-Curie, Hadamard and others. The day was fine and bright except for a short while. Besides the foreign scientists, the steamer was crowded with a large number of people from Moscow, of all ages, young men and women predominating. They were mostly workers in factories and ex-soldiers who had come to enjoy their off-day from work in the canal. The Moscow-Volga trip is a favourite holiday pastime with Muscovites. We started at 10-30 a m. passed through locks 6, 5, 4, 3 to Dmitrieff, and then retraced our path and returned at about 9 p m. to our hotel.

The steamer had a "guide," a young lady in her middle twenties, who spoke English quite fluently She gave us the story of the building of the canal in the usual tourists' language but found herself somewhat out of her depth when the scientists began to put to her some searching technical questions, e g. what is the discharge of the canal, what is the power used for pumping the water and so forth. Being unable to answer these questions she called out the 'Intourist Bureau Lady' to her help, but things did not much improve and she looked rather disconcerted. I think, partly as an act of revenge, she invited during dinner-time, some of the ques-

tioning scientists to dance with her, but they were rather too prosaic and declined the offer with thanks. However, she gave us a solo dance during the dinner.

Let me now recount the story of the Moscow-Volga Canal.

**Growth of Moscow**

The Metropolis of the Great Soviet Republic had, like other capital cities of the world, a very humble beginning. It grew round the fortified hill top on the Moscow river. The Kremlin was chosen as a residence by one Ivan Kalita or Ivan the Money-Bag in 1328 (claiming descent from the earlier rulers of Russia). This Ivan got a lease for rent-collection from the surrounding country, from the Tartar overlords of Russia who resided at Sarai near Astrakhan. As the power of the Tartars declined, that of the Dukes of Moscow increased till Ivan III, a descendant of Ivan Kalita, proclaimed himself to be the Tsar of all the Russias in 1462 with Moscow as his capital.

As Moscow grew, it was found that in spite of its central position, it had many disadvantages. The Moscowa, on which it is situated, is a tiny river, being a tributary of the Oka which is again a tributary of the Volga. The river was not navigable except by very small river craft, and most of the communications had to be by land. The great Volga, which forms the main artery for river communication in Russia, was about 80 miles due north of Moscow, but to make a river journey from Moscow to the Volga the steamer had to make a detour of 700 miles through Gorky, once called Nijni-Novgorod, now renamed after the Russian writer, Maxim Gorki (1868-1936) who was born there.

**History of the Canal**

As early as 1720, Peter the Great conceived the idea of shortening the route by means of a straight canal between Moscow and the Volga. He engaged a British engineer

named William Henning to devise the plans for a canal. "The plan called for the building of 100 locks with a water-level of not more than 6.5 feet each. The canal was to be navigable for vessels with a dead-weight of about 50 tons. A trip along the projected canal was to take at least three days (taken from Komarovsky)." Nothing came however of the plan, as Peter died shortly afterwards. It was resuscitated during the reign of Nicholas I (1825-1855), the chief objective being the transport of limestone and granite from the upper reaches of the Volga to Moscow for building purposes. Then another minor canal was undertaken, but the Moscow-Volga project was finally abandoned when the railway line was opened between Moscow and St. Petersburg on the plea (as we are told in this country) that the construction of the railway made the canal project unnecessary.

**Stalin revived the scheme**

The question was revived when the capital was transferred to Moscow after the Revolution of 1917. The water-supply problem of Moscow by 1932 had become very acute. The small Moscowa river and the artesian wells gave insufficient water even for a city of one million, but when the population threatened to grow to 5 millions, the situation became hopeless. In 1932, the gravity of the problem was realized. One writer puts the situation graphically, which may hold for many fast-growing Indian cities. *"They made great efforts with* 250 *kilometres of conduit pipes for passing water which were to give* 160 *to* 168 *litres of water per day per head* (32 *gallons*). *But only* 30 *out of every* 100 *houses were properly watered. Except at the centre of the city, one could see the housewives with their buckets making a long queue round the water-taps. During summer the pressure within the conduit pipe fell very low. On the upper storey the occupants vainly opened their taps but there was nothing but a vague sound in the water pipe."*

In addition to the necessity for having a larger water supply for the growing population, Moscow was

growing fast as the greatest industrial city of Russia. The growth of industries was threatened owing to a shortage of water.

The matter naturally came to the notice of the Council of People's Commissars, and Stalin took personal initiative in reviving Peter's scheme. He got the plan redrafted by a committee of engineers and when the new plans were ready he ordered their immediate execution. It is in the fitness of things that a giant statue of Stalin in the posture of an orator haranguing the public, greets the visitor as he enters the Khimky station.

**Engineering Difficulties**

What were the engineering difficulties which led to Peter's scheme being pigeon-holed for two centuries?

Though the distance from Moscow to the Volga is only 128 kilometres (80 miles), the level of the Volga is 107 metres, above the sea and that of the Moscowa river is 120 metres, but north of Moscow, the watershed dividing the two rivers reaches a height of 160 metres. It is a hilly ridge 40 to 60 metres high and nearly 25 miles in breadth. The canal had to be cut through this ridge, and water had to be raised about 52 metres from the bed of the Volga to the top of the ridge, and then let down again on the Moscowa side.

Let us see how this task has been carried out.

The canal starts from the city of Kimry on the Volga, 80 miles due north of Moscow. Here a dyke made of earth and stones has been thrown, and it wedges the Volga against the barrage of concrete 216 metres in length and 22 metres in height.

As a result of this barrage, 125 sq. miles of land have been inundated and a lake has been formed containing about a billion cubic metres of water. This submerged region has received the name of the Sea of

Moscow. Here were an old city, Kortcheva, some villages and estates which have been engulfed.

These villages have been rebuilt at some distance and new land has been given to the peasants.

Round about the barrage, the central hydro-electric station Ivanenko develops a power of 29,000 kilowatts. The canal here has a depth of 5½ metres and a width of 85 metres and can receive vessels having a draught of 4 to 5 metres of water.

**An Engineering Feat**

From Kimry the canal runs. But at several stretches it cuts across 5 lakes, occupying a total of 19 kilometres upon the whole course of 128 kilometres.

Water has to be raised at stages by the pumps at six stages marked by the locks 1 to 6. Lock 6 is near the village of Ikcha, which occupies the highest point of the ridge. Then running for some distance, it drops by means of locks 7-11 to the level of the Moscowa river.

The 10th lock brings the canal to the level of the Moscowa. This level istelf has been raised with reference to the old level of the Moscowa river, because the 11th lock has thrown a barrage across the river, forming a vast lake to the south-east of Moscow. A hill, rivers, railways—these were the obstacles on the way.

Two hundred detailed pieces of work were required to overcome them. Each one of these is a work of art within the double sense of the word; because the construction has to respond to an objective whose technical specifications were very rigid, and also amongst themselves, each item presented a particular character and an original problem.

Amongst the more important, the following may be counted:—

11 locks already enumerated.

11 barrages isolating the lakes.
8 central hydro-electric stations.
19 railway bridges
2 tunnels.
5 pumping stations.

The pumping stations are required for filling the different sections of the canal up to the top, for it is only the first section after the barrage on the Volga which can be fed directly. The pumps are extremely powerful, each one being able to deliver 20 cubic metres (nearly 600 cusecs) of water per second.

**Ucha Reservoir** One of the artificial lakes, the Ucha reservoir, impounds 260 million cubic metres of water and is used as the water reservoir of Moscow. Here the silt and mud settle, and the clear water flows south through a special reinforced concrete channel about 17 miles long to the Stalin Water Works. Here it is purified and passes into the pipes of Moscow's water distribution system. The Ucha reservoir contains sufficient water to satisfy the thirst of the population for a month, even if the pumps fail entirely.

After the completion of the Moscow-Volga Canal, the water supply problem of Moscow has been completely solved Each inhabitant of Moscow gets 500 litres (nearly 110 gallons) per head. This is about 4 times the amount which a citizen of Calcutta gets. Further, industries can now grow to any extent round Moscow. They will not be held up due to water-shortage.

**Moscow as a Sea-port** But the canal has done much more service to Moscow than merely solving the problem of water-supply.

The Moscow-Volga Canal already enables large river steamships to pass into the heart of Moscow. The reconstruction of the Mariinsk canal system will ultimately allow them to proceed to the Volkhov river, into

Lake Ladoga, and thence to Leningrad, or through the Baltic-White Sea Canal to the White Sea.

The Don-Volga Canal which would have been finished but for the outbreak of the war, and the Manych-Kura Canal will give direct access to the Black Sea. Finally, a canal linking the Chusovoya, a tributary of the Kama, with the Islet, a tributary of the Ob, with the Yenessei and the Angara, will create an enormous waterway from the Volga to Lake Baikal.

Eventually, Moscow will be the centre of the most remarkable system of inland waterways in the world. It will be the sea-port of all the four seas surrounding Soviet Russia, and will communicate with all the oceans directly excepting the Pacific. It is only one item in the gigantic scheme for unified multi-purpose development of the waterways of Russia, which is illustrated here.

**Greater Volga Scheme**

The Volga, "Matuska Volga, or Mother Volga," as the Russians affectionately call their great river, has from time immemorial been a great and important waterway; it passes through lands containing about a quarter of the entire population; it carries some 35 per cent of the river traffic of the Soviet Union (about 30,000,000 tons a year), but it suffers from some serious defects. For example, it suffers from enormous floods during the spring, when great ice-flows are driven rapidly down-stream by the fast-flowing current, while during the summer and autumn, navigation is impeded by shallows. In the past large vessels could not proceed above Kazan.

Furthermore, many of the lands lying along the eastern bank of the lower Volga suffer from drought. The irrigation of such vast areas is possible if a large amount of power is available for pumping water, since the steppe lies at a height of 200 to 300 feet above the level of the river. Consequently, in order to make the fullest

use of the Volga and the adjacent lands, three problems had to be solved—the creation of a deep navigable waterway, the provision of electric power, and the building of extensive irrigation works on the left bank of the river between Kuibishev and Kamyshin. In order to solve these problems the "Great Volga" scheme was initiated, and a great deal of the constructional work has already been completed. Eventually, about 1,500,000 acres of land will be irrigated for wheat production.

**Water Power for Agriculture and Industry**

Large dams, five on the Volga and three on the Kama, in addition to several smaller ones, have been built. A canal has been provided to cut across the bend of the river at Kuibishev, originally Samarra, now called after the Bolshevik leader who was the first President of the State Planning Commission, as well as canals and locks to allow vessels to pass round the dams. These dams regulate the flow of water, holding back the spring flood waters, and filling the lower course of the river during the summer. They have also brought about an increase in the depth of the river and a reduction in the speed of the current, so that navigation is now much easier than it was in former days. The dams, by raising the level of the water, also provide power for a number of hydro-electric stations, several of which are already operating. Eventually there will be twenty of these power stations, with a total annual output of electricity of 6,500,000 kilowatts, the total energy output being about 30,000 to 40,000 million kilowatt hours which is about three times the amount produced in the Tennessee River. This energy will be of immense importance to the industrial development of the regions lying near to or even some distance away from the Volga, where local deposits of peat and combustible shales, and coal from the Donetz or oil from Baku, are the only other sources of power.

The Kamyshin hydro-electric station will have a vast reservoir, able to supply water to irrigate more than ten million acres of arid land, which will be

able to produce an enormous crop of wheat. Hydro-electric power will operate pumps which will convey water to a number of small reservoirs in the drought-stricken area. This project, however, would reduce the amount of water entering the Caspian to such an extent that the level would fall considerably, and the ports and fisheries would be ruined. In order to avoid this the upper courses of the northern rivers—the Pechora, Sukhona, and Vichegda—have been tapped, and are fed into the Volga, through the Kama. This has necessitated the construction of a great lake at the junction of the Vichegda, Kama and Pechora. Ships will eventually be able to sail directly from the Arctic along the North Dvina and Vichegda, or along the Pechora, carrying timber and coal, for example, down the Kama, and by way of the Volga to the south.

**Development of Rivers**

I have related at some length the story of the multi-purpose development of Russian rivers and the fruits they have borne on account of the interest they are likely to arouse in this country. The above short account makes it clear that the Russians look upon their rivers as great sources of potential wealth and strength and have evolved methods for getting the most out of them. The traditional use of rivers was only for navigation and irrigation, but in our country navigation has been entirely neglected and most of the rivers which were once highways of navigation have been allowed to fall into decay, because it was thought that after the development of railways the rivers were quite unnecessary for navigation. This has been a very short-sighted policy and has led to the deterioration of most of our rivers. The Russians have further tried to harness all rivers for power development and use the energies so obtained for irrigation and industrial purposes.

*It will surprise many of our readers to know that even the Volga is a small river compared to the Ganges-Brahmaputra system and the Indus. According to an American survey, the mean discharge of the Ganges-Brahmaputra system is nearly* 12 *lakhs of*

*cusecs which is nearly six to seven times as great as that of the Volga and her tributaries (one and three-fourth lakhs). The discharge of the Indus is two to three times as great. Now, as all Indian rivers arise from high mountains, it is clear that they dissipate a far larger amount of energy than all the Russian rivers taken together. How much of this potential power could be harnessed cannot be said without a proper survey of the rivers from the point of view of power generation but it is obvious that the potentiality is great and if these rivers could be harnessed for multi-purpose objectives, the country would be enriched beyond all measure*

**Scientists help Gigantic planning**

These ideas have been preached several times, but those who are in charge of reconstruction have neither the patience nor the knowledge of the magnitude of the task involved. When the Russians wanted to develop their rivers, they opened no less than 5,200 stations to observe the discharge of rivers at different places and to make an analysis of the rainfall and run-off of these rivers. I am quite certain that nothing of the kind has yet been attempted in this country and unless the preliminary data are collected and analysed, no proper plans for the harnessing of the rivers can be developed But who is going to do all this? When in 1921, amidst civil wars fomented by bourgeois countries, and the miseries left by the last war, Lenin was contemplating his great plans for the electrification of the whole country, of collective use of land and water (or what we call the multi-purpose use of rivers), the English writer H. G. Wells paid a visit to him in the Kremlin. Lenin discussed with him his great plans. To Pundit Wells, the drafting of such grandiose plans in a ruined and starving country appeared so absurd that on return to England he referred to Lenin "as the dreamer in the Kremlin."

But though the dreamer passed away shortly afterwards, his mantle fell on worthy successors who called a whole host of scientists and engineers to assist them in giving practical shape to these dreams Now they are no longer dreams but refreshing realities.

**Where visions have remained only dreams**

But dreams do not always turn to realities. At the time when Lenin was thinking of the scientific development of his country, another great dreamer Sun-Yat Sen was thinking of the development of his own country, China, on similar lines. In his "Three Principles of the People" he gave a plan for the development of Chinese mineral wealth, of the land and water in the same way as Lenin had done But Russia was a free country, while China was not. The Russian Government could mobilise her whole army of engineers and scientists for the execution of the plans, while China remained a prey to civil war, conflicting ideologies and foreign aggression. In fact, Mr. Borodin, whom I had the pleasure of meeting at a dinner at the Chinese Embassy at Moscow, told me that the representatives of the Great Powers to whom Sun-Yat Sen sent his plans for opinion, dismissed it curtly as "grandiose" and impracticable. But the thoughts given out by Sun-Yat Sen have sunk into the minds of the Chinese and after the termination of the present war, we can look forward to a large-scale development of China on the same lines as that of Russia. In fact American experts have already found that a single dam on the Yangtsi alone will give them as much water power as the whole of the United States of America.

In India even the dream does not exist in the minds of the leaders and conflicting medieval ideologies are still continuing to darken their mental outlook.

# VI

# Leningrad Notes

THE ACADEMY OF SCIENCES arranged for a three-day trip to Leningrad, the home of the Academy for 209 years before its transfer to Moscow in 1934. We boarded the train at 6 p.m. on 25th June, and arrived at Leningrad at 11-30 a.m., the next day, a journey of nearly seventeen and a half hours for a distance of 500 miles, but before the war it was only a night's journey. We were told that the coaches were 35 years old, but they were not uncomfortable.

If one wants to see "what is destruction in war," one has to take a trip along this line. The Germans came astride this line for a large part of its length and Leningrad was besieged from September 1941 to January 1943. While departing, the Germans destroyed everything they could lay their hands on; all bridges were blown up, railway stations were wrecked, lines were torn, and cities and villages reduced to rubble-heaps. But the Russians were quick to effect temporary repairs, and when the first train arrived from Moscow to Leningrad after the departure of the Germans shortly after the raising of the siege, it was a great day for the citizens of Leningrad.

We were lodged at the Hotel Astoria, a commodious first class hotel generally reserved for foreign tourists.

**Leningrad—the most beautiful city**

Leningrad, city of Lenin —*alias* Petrograd, Slavic name for the city of Peter— *alias* St. Petersburg, German name for the city of the

same sainted Peter (who, however, led a very unsaintly life) is, I was told, the prettiest city in Soviet Russia. I had no way of verifying the statement as my experience of Russian cities is confined only to Moscow and Leningrad. But Leningrad is certainly one of the prettiest cities I have ever seen. Built on both sides of the broad Neva, and its numerous branches, and on the islands, at the head of the Gulf of Finland, Tsarist Russia spent vast sums on its palaces, official buildings, castles, museums, streets, parks, bridges, monuments, and churches. The Neva and its branches are solidly embanked on both sides, and skirting the river frontage are broad streets, the other side of which are lined with a magnificent array of buildings. The river and its branches are spanned by a number of bridges of which the Kirov Bridge, renamed after a martyred Bolshevik leader, is the biggest and broadest. It would be too tedious and rather out of place to give a description of all these architectural achievements, which one can easily find in tourist books We found the magnificent churches mostly deserted or converted to museums and educational institutions, because the State no longer pays for their maintenance. The palaces are mostly converted to office buildings, scientific institutions and other useful organisations.

As I mentioned earlier, Peter the Great, weary of the opposition from reactionaries at Moscow to his measures of Europeanisation of Russia, decided to shift his capital to the head of the ancient highway of commerce with the West across the Neva with the determination to open a "Window to the West" for the influx of new ideas from Western Europe. But he was not very careful in his choice of the site, for it was marshy, unhealthy and subject to floods, and wooden piles were driven to secure solid foundations for its stately buildings. With the advent of industrialism Leningrad became an industrial city, in fact for a time the largest industrial area in Russia with large colonies of labourers, poorly housed, half-fed and mostly in rags. So heavy has been the mortality amongst the poorer classes, engaged in building

operations and industrial work, that Leningrad gained the reputation of being built on 'human bones'. The situation was somewhat similar to that of Calcutta which was also founded on a marsh, a few years earlier than Leningrad (1690) and where palaces of wealthy people flourish side by side with the mean bustees of half-starved and ragged labourers and the lower middle class.

I asked a Russian friend why Peter who did so much for Russia and was the actual founder of the city, was deprived of his glory in preference to Lenin. He said that in the Tsarist city, poverty and squalor amongst the labourers and factory workers existed side by side with the pomp and splendour of the Tsar, his nobles, military officers and chinovniks (civil servants), and for a century the conflicting atmospheres of con tempt, fear and repression on one side and hatred, fear and oppression on the other side produced a most unnatural state which led to frequent strikes and terrorist outrages. Ideas of Revolution naturally obtained a fine breeding ground in the city and it was here that Lenin and his comrades worked for years underground amidst the factory workers till the cataclysm of 1917 transferred power to their hands. The present Government has therefore rightly renamed the city after Lenin.

This was no answer to my query but I kept mum, I felt however that it was not necessary to deprive Peter of his well-merited glory in order to honour Lenin, which the latter certainly deserved, but could have received in a more graceful manner.

**Seat of Culture** Leningrad being the former capital city of Soviet Russia is full of scientific institutions, museums and libraries. Excursions were arranged to the Komarov Institute of Botany named after the President of the Academy.

This Institute is the synthesis of two former botanical institutions in Leningrad, viz., the main Botanical Gardens founded in 1714 by Peter the Great and so long

under the People's Commissariat of Agriculture, and the Botanical Museum maintained by the Academy of Sciences. The administration of the Institute is now transferred to the Academy. The Institute's herbarium contained about 5 million specimens in 1943. The library of the Institute, containing more than 135,000 volumes, which include the most important literature on the subject of Botany since the 15th century, is one of the best libraries in the world. Visits were arranged also to the Library of the Academy of Sciences, U.S.S.R., to the Zoological Museum and the famous Pavlov Institute of Evolutionary Physiology and Pathology, where the great Russian physiologist Pavlov who died in 1936, at the age of 87, worked. He is the author of the famous theory of Conditioned Reflexes and had won worldwide celebrity as a front rank worker and was awarded the Nobel Prize in 1904. But the Tsarist Government were too niggardly to him and he had to pay from his own pocket the salaries of some of his assistants and laboratory hands. He was not very friendly to the Revolution and often spoke against the excesses committed by the Bolsheviks, but they never touched him and gave him as much for his laboratory as he wanted. The Institute is now presided over by his foremost student Orbelli, one of the Vice-Presidents of the Academy, and a leading physiologist of the world.

**Defenc eof the City**

On our arrival in the city, we were taken to see the "Defence of Leningrad" Exhibition. The story of the defence of Leningrad is told in several publications now available in the market, but the visitor to Leningrad has a chance of getting a firsthand knowledge of this grand epic of the World War from the magnificient collection of pictures, maps, arms and weapons at the Exhibition It shows how the Germans came and cut off Leningrad, took its outlying suburbs, and power houses, and rained bombs on the city; how the defenders of Leningrad organised defence; how people kept the great Kirov arms factories going in spite of repeated bombing, and continued starvation. Large numbers were

evacuated before the Germans could draw their nets tight, but of those who remained many died of privations and diseases, and no wonder, because except for a route opened over the frozen Ladoga Lakes, there was no supply for a year and a half and all animals were killed. One man told me that he lived for days on dried pig skin and water.

The exhibition contains a pyramid of German helmets, each helmet marking one thousand Germans dead or captured. From the size of the pyramid, it appears that the Germans lost over a million men in their assault on Leningrad. Just a few days earlier, I had been to the Art Gallery in Moscow where I saw something similar, a medieval picture showing Tamerlane inspecting a pyramid of skulls, belonging to the victims of his wars. Has mankind progressed much in the ideas of humanity since the days of Alexander and Tamerlane?

**Nazi Vandalism**

We had the chance of seeing a few devastated regions round about Leningrad. These were Peterhof, the palace city 23 kilometres from Leningrad, the summer residence of the Romanoffs, and the premier Tsarist Palaces, expanded and beautified by successive generations of Tsars. Then there was the great Pulkova Observatory, the Greenwich of Russia, at nearly sixty degrees north latitude and Puskino, the former Tsarskoe Seloe, the Schusselberg Power House. I chose Pulkova. All the astronomers present went to see the place. There were Sir Harold Spencer-Jones, the Astronomer Royal of England, Prof. Harlow Shapley, Director, Harvard College Observatory, our Russian colleagues, Director Neujmin Shahn of the Simeis Observatory, Crimea, Ambarzumian, Michailov, and many other foreign astronomers in the group.

The little village of Pulkova where the famous Observatory is built, is situated on the low hills of the same name about 15 kilometres to the south-west of the city. What we saw there simply staggered us. There

is nothing left of the Observatory excepting a heap of bricks and a number of walls. The lens of the big Refractor Telescope for which Pulkova was celebrated was taken away early for safety, but the dome and the mounting are now all a mass of jumbled metal which in places had run into molten chunks due to the heat produced by bomb bursts. In some places deep craters marked the sites of telescopes and other instruments. We were told that the German front line was just half a mile to the south and the Observatory frequently received direct hits. The destruction of the Observatory as an act of extreme vandalism is of course neither unique nor one-sided. It shows that Attila, Chenghiz Khan, and Tamerlane were 'saints' compared to the warlords of the twentieth century. The medieval warlords had their moments of chivalry, e.g., Attila the Hun retired from the gates of Rome at the request of Pope Leo, but probably, there has not been a single chivalrous incident of that kind during the six years of World War II. The local astronomers had to transfer their activities to the eastern regions of the Soviet Union and unretarded by the fate which overtook their beloved Observatory, they carried out successful important observations in Kazakisthan during the total solar eclipse of September 1941. The Soviet Government has a plan for building the Observatory on a grander scale as early as possible.

Our friends who went to see the Palace City of Peterhof all told us the same tale. The Germans seized it in September 1941 and made a complete wreckage of it ' The Peter and Paul Cathedral at the centre of the city was the chief German observation post from which they could check artillery fire aimed at the battleships sailing across the gulf from the great arsenal city of Cronstad. The Russians have renamed the place Petrodvaretz, and have plans for rebuilding the palaces and monuments exactly as they were before the German invasion.

**Meeting old friends**

At the end of the last war in 1921, I spent a few months in Germany and worked in the laboratory of Professor

Nernst in Berlin to obtain experimental verification of my theory of thermal ionisation which has now received application in such diverse fields as the stars, Ionosphere, the theory of flames, arcs and explosions. I had the opportunity of coming into close contact with such great names in German science as Planck, Nernst, Einstein, Haber and Laue. At the same time a number of Russian scientific workers had been sent by Soviet Russia on a scientific educational mission and most of them had already training in Germany. These were Dr. Joffe who had worked under Roentgen (discoverer of X-rays) at Munich, Dr. Rodzdestvensky, who I think had a Ph D degree from Strassburg, and several others. I became very intimate with these Russian friends with whom I had spent many evenings, talking of our respective countries. I found after 24 years that Dr. Joffe is now the director of a magnificent physical laboratory at Leningrad (Physico-technical Institute) where a large number of experiments on semi-conductors, insulators, thermo-elements and other electrical problems were being worked out. Prof. Joffe is also erecting a cyclotron of the same kind as we have done at Calcutta, but on a far more magnificent and generous scale. The building is about 10 times the size of my present building with a huge dome over the cyclotron proper to increase architectural beauty and providing for quick transport of materials. Prof. Joffe has about a hundred research workers under him and is Physical Secretary of the Academy Prof. Rodzdestvensky had done great fundamental work on Optics but as the Director of the Optical Institution, he undertook, at the request of the Soviet Government, large scale industrial work on the manufacture of optical glass, lenses, prisms, telescopes, cameras and optical apparatus of all types. Prof. Rodzdestvensky had died in 1941 shortly before the outbreak of the war but I was told that he had done very grand work for Soviet Russia and the Optical Institute now employs about 5000 scientific workers and is responsible for the manufacture of all optical equipment for Soviet Russia. Though it has grown into a huge manufacturing concern, the research side is being

maintained on a far more lavish scale. I could not meet my other friend Prof. Lazarev, Director of the Physical Institute at Moscow, who was ill at the time of the German invasion and was evacuated to some place in Central Asia where he died of exposure. Leningrad had another cyclotron at the Radium Institute under Khlopin finished just before the war but it was damaged during the siege and is now undergoing repairs.

**Russian Interest in India**

I met Dr. Kalianov, successor of the famous Buddhist scholar Tcheravatsky who attained *Nirvana* just two years ago. The oriental section of the Academy of Sciences has done great work in Indology and the names of its previous workers are well-known to all scholars of Indology. The famous Vedic Dictionary prepared by Roth and Bohtlingk about 70 years ago is yet a standard work. Tchervatsky was unrivalled as a scholar of Buddhism. Kalianov is now engaged in a translation of the famous Indian epic Mahabharata and while taking leave of me at Leningrad he bade me farewell in Sanskrit with the words *Punaragamanaya, punardarshanayacha* (to come again, to see again). I also met Pandit Rahul Sankrityayan (and his Russian wife), the famous Indian explorer and scholar who had arrived in Leningrad about a month earlier and had been employed by the Oriental Section of the Academy as a research worker and in charge of the library on Pali and other Buddhist manuscripts. Unfortunately I could spend only a short time at Leningrad and could not see as much of it as I wished to do.

# VII

# Twentyfive Years of The Soviet Union[1]

THE TITANIC STRUGGLE which the Soviet Union has been putting up against the most powerful military machine of all times has been a surprise to most Governments and peoples of the world including even Germany. The history of a state which began to industrialise itself barely two decades ago and which has proved a match for Germany which is one of the leading industrial and militarised countries with hundreds of years of technical and scientific efficiency, is a matter well worthy of study by every country, which wishes to get on in the present-day world. Twenty-five years ago the proletariat came to power in Russia, emancipated all the colonies of Czarist Russia, consolidated their revolution against heavy odds, both external and internal, and set to the task of industrialisation and modernisation on a scale unheard of in all history. It is opportune at the present moment to make a brief *resume* of this historic revolution achieved twenty-five years ago.

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[1] (Written on the occasion of the 25th anniversary of the Soviet Revolution for 'Science and Culture' October, 1942).

The Revolution embracing all phases of human activity may be divided into :—

1. A technological revolution—passage from age-old agriculture and palaeotechnic* methods of production to modern industrial methods based on science and neotechnics.
2. A political revolution—passage from Czarism to what was termed at the time as the Dictatorship of the Proletariat.
3. A socio-economic revolution—passage from capitalism and private property to communal ownership, and abolition of private interests.
4. A religious revolution—passage from different forms of established religion to a new system based on a Darwinian picture of the world.

The Russian Revolution was rightly regarded as the most momentous experiment with human society, as no other previous movement could approach it in the extensiveness of its programme, in the radical nature of its doctrines, and in the stupendousness of the scale of operations. The movement was hailed with unbounded enthusiasm in some quarters, and was denounced with equal bitterness in others. Even people with apparently no motives of self-interest to vitiate their judgment, were profoundly sceptical. Flames of controversy were incessantly raised round each action of the Soviets, and it was difficult to see the essential from the non-essential. It was the veteran socialists Beatrice and Sydney Webb, who were among the first to give a clear picture of the doctrines, the programmes, and lines of action of the Soviets, and cleared the way for a just appraisal of the Soviet Experiment. After 25 years, it is now possible to judge the Soviets on the surest criterion of experiments, viz., actual results.

*Palaeotechnics and neotechnics are used in the sense given to them by Louis Mumford in his "Technics and Civilisation." Palaeotechnics mean industrial operations based on tools, and individual workers formed into artisan classes Neotechnics mean operations and full and based on science and technology and factory system, rational development of country's resources in power, minerals, and agriculture products

Now, what were the major elements in the Russian programme? Opinions have varied according to the training and make-up of the critic, and to the particular incident on which attention was focussed for the time being. But if we take an objective view of the case, there can be no doubt that of the four revolutions, the technological revolution is the most essential, as the first task of man is to live and organise for living. The other activities, political, economic and religious have grown mainly round attempts to live.

**Technological Revolution**

Judged from this point of view, there cannot be the slightest doubt that the Soviet Experiment has been an unqualified success. Before the Great War of 1914, Russia was mainly an agricultural country; 94 percent of her people lived in villages dispersed over the great plains, and only 6 percent were city-dwellers. Russian industry was in a very backward condition. As an index of her backwardness, we can refer to her production of electrical energy in 1917 which was only 2,500 million units; this was exceeded at that time even by tiny Switzerland, and the per capita power consumption was 1/100 of countries like U.S.A. or Norway and not much better than that of present day India. Other essential heavy industries e.g., chemical, metal, and engineering, were equally undeveloped, and Russia had to depend on foreign countries for all the essentials of modern industrial life, e.g., chemicals, locomotives, electrical machinery, telephone and telegraph equipment, etc. Whatever small industrial establishments there were, were mainly controlled by foreign capital and had to depend entirely on foreign technicians for their running. As regards paucity of scientists and technicians, we may refer to the case of the physical sciences. In the whole of vast Russia, there were not more than 15 trained physicists, having the intellectual calibre of a London Ph.D. The same may be said of other sciences and technical subjects.

The collapse of Russia after two years' war in 1916 was due not so much to the inefficiency of the Government and the military system as to the breakdown of her industries and her transport system. The Czarist Government, learning from her defeat by Japan in 1905, had concentrated on the perfection of the military machine, had raised and drilled huge armies, but had failed to see that the modern military machine is integrally connected with the industrial life of the country and had paid no attention to the development of her internal resources.

The Soviet Government, when they forcibly took over power from the previous regime, had in the fore front of its programme the technological revolution, and in spite of Civil Wars inside, invasions from outside, open hostility of foreign exploiters, and jeers of doubting Pundits like H.G. Wells and Will Durant, they kept to their programme with single-minded devotion. As we have mentioned earlier, the success of their programme (known popularly as the various five-year plans) is exemplified by the magnificent resistance which Soviet Russia offered against the mightiest military machine the world has ever seen, but figures will be more convincing to an objective mind. Before the outbreak of her war with Germany, Russia had increased her production of electrical power by 20 times (from 2,500 million units in 1917); she had developed her mineral industries (oil, iron, coal) nearly as many times. She had built up her heavy industries—including chemicals, automobiles, aeroplanes, and transport, from almost nothing to a fair degree of self-sufficiency with exclusively Russian capital and Russian technical personnel. The internal resources had been accurately surveyed, and this revealed that potentially she is as rich in natural resources as the United States of America. Nor has she neglected agriculture. She had made large-scale use of science for the rational development of her agriculture, had introduced new and revolutionary methods like vernalisation and developed huge tracts of cultivable waste land. The standard of living has risen very appreciably

and wealth has been much more evenly distributed. Even her enemies, declared or undeclared, have paid a compliment to her by copying in part her methods of production, development of natural resources and control and distribution of the wealth so created.

The Technological Revolution started in Western Europe with the discovery of the steam engine, but has been a slow and gradual process in these countries and the U.S.A. It has gradually led to the immense increase in their material and moral power. Older countries like China, Russia, Eastern Europe, and Latin America remained wholly or partly unaffected for a long time, and this indifference led to their decline in political power and to their exploitation by the various West European nations and the U.S.A. It was only Japan which early awoke to the danger, and set herself to the task of assimilating unreservedly the lessons of the Technological Revolution.

We must therefore conclude that as far as the Technological Revolution is concerned, the success of Russia has been complete and unqualified, and if Russia were allowed to develop her resources undisturbed, she would have attained a prosperity and a strength unequalled in the history of the world.*

The reader might ask: why did not the Czarist government undertake to effect a part at least of the Technological Revolution, which, if properly carried out, would have saved them. This could have been achieved without a radical change in the political or the economic organisation, and as a matter of fact, far-seeing scientists like the great Mendeleef had again and again called the attention of the Czarist ruling class to the urgency of the Technological Revolution. But theirs was like the voice of Cressida, uttering prophecies which ulti-

*If Russia were allowed another 5 years to develop herself at the rate she had shown since 1929, no combination of powers in the world could have defeated her. It was an appreciation of this knowledge which perhaps led to the precipitation of the Russo-German conflict.

mately turned to be true, but which were never believed at the time, probably because it was against the psychological make-up of these persons. Anyhow, a perusal of contemporary history shows that the Russian rulers did not appreciate the advantages to all classes arising from the Technological Revolution, or dreaded the increment of power to the common man which would accrue from such a change, and even the best amongst them were suffering from intellectual confusion caused by semi-theatrical writings of men like Leo Tolstoy in plain living and the so-called christian ideals. Anyhow, the Czarist rulers could not persuade themselves to change their minds, and went straight to their doom. Their stiffneckedness precipitated the Political and Economic Revolutions which brought untold miseries upon the population during the transitional period. Had they been reasonable, or appreciated the advantages of the Technological Revolution, and acted with energy for this end, the political and economic transformation might have been quite gradual, and unattended with the violence, which has given the Revolution a bad name. But as events happened, the violence probably could not be avoided.

**Political Revolution** The Political Revolution in Russia was described for a time as transition from autocracy to dictatorship of the proletariat, but some observers are at pains to point out that actually it was merely a substitution of dictators like Lenin and Stalin for Czar Nicholas at the Kremlin. A little observation shows that the criticism is entirely superficial. Czarism stood for a privileged class, a corrupt and slow-moving bureaucracy, and had no programme for industrial or agricultural development. As Sydney and Beatrice Webb have pointed out in their searching analysis, the communist party machine, which monopolizes the political power, corresponds in its ideal and composition almost to Plato's Philosopher-Rulers, 'a set of rulers carefully chosen for their character and powers of leadership, having almost ascetic habits, and

with a psychological make-up against the chance of having their judgment vitiated by private or privileged class interests'. Very few people can conform to such high standards, and the Soviets have to weed out periodically undesirables by a critical examination of the actual records of each member.

As regards officers of the State, according to the fundamental principles of communism, people are selected to posts according to the records of their actual achievements, while in capitalistic countries (like England), the accident of birth plays a great part. In so-called democratic countries (like England or U.S.A.), the higher posts go to men occupying high positions in a political party, formed on the basis of worn-out principles. It reduces to the preference of birth or gift of pandering to the gallery to actual capacity for to work. The nearest superficial approach to the Soviet system is the Institution of Civil Service, but both in England and U.S.A., they occupy a rather subordinate position and are not allowed to take any initiative and essentially owe allegiance to the propertied class. In India the Civil Service enjoys more power, but they have been more like Turkish Janissary guards, recruited at an early age from amongst youths of England (educated mostly in the reactionary public schools) and to some extent of India, and drilled by an iron discipline to the services of a reactionary and unprogressive imperialism. Such Indian Civil servants who show too early independence of character, or betray some regard for their country's interest are usually switched off to the sanctuary of the "Judiciary," or some other inoccuous job. Such as happen to come to the higher administrative posts are usually men who in the phraseology of Lord Curzon "have proved themselves to be as safe as Dead Mutton."

**Economic Revolution** The Socio-economic Programme of the Revolution involved the nationalisation of the means of production both of factories and land. The sudden change-

over from a capitalistic system and outlook to socialism and collectivisation was indeed such a terrific jolt that some mistakes born of inexperience were committed in the early stages of the economic revolution. When the Bolsheviks first assumed power, all private property particularly in the means of production was abolished, with the result that production and supply of even essential goods were seriously affected; interchange of goods between cities and the country came practically to a standstill. It was as if the circulation of the life-blood of the State had nearly stopped. The reasons for this deadlock was not purely mechanical failure but the sabotage by the counter-revolutionary bourgeoisie and landowners, the persistence of the old capitalistic and individualistic psychology and traditions, and the intervention by about a dozen capitalist powers of world. Fortunately Lenin sensed the danger in time, and introduced the New Economic Policy (N.E.P.), which allowed liberty of production and of sale to peasants, small manufacturers, and retail businessmen, keeping in the hands of the Government all foreign trade, heavy and medium industries, control of transport, banking, and all public utility services. This saved the country from an impending disaster, but led to the creation of Kulaks, or rich propertied peasants and small manufacturers in the villages. The Soviet leaders sensed a danger in the emergence of a new propertied class, which they tried to extirpate by rigid control and confiscation of properties. This led to destruction of grain, and slaughter of animals on the part of the misguided infuriated peasantry, who like the peasantry all over the world, were more alive to their immediate possessions than to any visions of a prospective improvement. The result was a terrible shortage of foodstuff and live-stock throughout the years 1930-1932, which caused death according to the Rightist press

through starvation of millions of men. Ultimately Soviet Russia had to make a compromise. It had kept all external trade, heavy industries, banking, transport, communication, mining and power industries in its own hands, and left the small dealer, manufacturer and peasant in undisturbed possession of his property. It has tried to meet the Kulak menance by large scale collectivisation of agricultural farms. Gone is also the uniformisation of all ranks within a factory or what Molotov once humorously described as 'Complete planning outside the factory, and complete chaos inside'. Now the hierarchy,—managers, directors, engineers and scientific workers, foremen, skilled and unskilled labour, has been introduced, on graded scales of remuneration, thus ensuring to each man proper recognition of his merits. They have however, insured against the emergence of a propertied or privileged class by keeping all 'big business' under Government control. The essence of this long history of travail and reconstruction against heavy odds is this. The Bolsheviks, right at the beginning of the Revolution, sought to go over to a communist system as nearly as possible, whose principle is "To every man according to his needs: from every man according to his capacity." This did not work because the necessary output of material production had not been effected. The slogan "To every man according to his ability" has therefore been adopted in order to stimulate production during the present period, which according to them, is essentially transitional. They claim to be marching towards full-fledged communism when the psychology of the people is gradually changed by education and when material production has advanced sufficiently to satisfy all men's reasonable needs.

**Religious Revolution**

Of the four-fold revolution, the religious one is the most difficult to judge, and the application of its lessons to other countries will be risky. Most of the age-worn religions are based upon a picture of the world and of ultimate realities which modern science has proved to be far from true. They look upon the Earth as the centre

of the Universe created at the caprice of an Almighty Being about 5,000 years ago according to the Christian scriptures and they look upon man as fashioned in the image of the Creator. They ascribe the troubles of mankind to some vague doctrine of original sin, or to some constant contention between the principles of good and evil. This picture is contradicted by modern theories of cosmogeny, the Darwinian theory of natural evolution, and discoveries of prehistory and ancient history. Though old forms of religion still claim millions of devotees, it is sure that with the spread of universal education, of scientific knowledge and with the growth of industrial life, people will gradually outgrow the older superstitions and be guided by more rational principles in life. The religious controversy in Russia reached white heat, because prior to the Revolution, the Church proved to be a subservient tool of the Czarist Regime. The Czar was the head of the Church, "the Little Father," and the clergy always exerted their influence on the side of autocracy and fostered ignorance and superstitions by the performance of 'miracles,' organisation of Church services, festivals dedicated to saints and pilgrimages to holy places possessing miraculous ikons. The Bolsheviks, be it said to their credit, left the Church at first undisturbed, but when the clergy began to range themselves on the side of the counter-revolution, they had to deprive them of their franchise with hold State patronage, and ultimately close the churches, and convert them to schools and educational museums. Not content with that, they organised godless societies and demonstrations in which the ridiculous parts of the old religions were exposed. They tried to organise, in a crude way, new festivals and new calendars. Thus the festival of St. John became the festival of the war on Superstition, that of St Ilya the festival of Natural Science and the Electrification of Russia. A new generation is claimed to have now grown up, to whom the old religion is a matter of history. With the spread of education and of scientific knowledge, the old religion, having few votaries left, has been dying a natural death.

**Conclusion** We have given a short and objective review of the Russian Revolution, because we believe that as regards political thought, this country appears to be in the same stage as was Russia of 1900, or China of 1911. The ruling class has shown itself to be determined opponents of "Technological Revolution" to a greater degree than political or economic reforms, probably because they fear that if the economic condition of the common man is substantially improved, power may slip from their hands. The 'Patriot groups' suffer from intellectual confusion; some are guided by the obsolete half-theatrics of a Tolstoyan ideal, others utter only some unmeaning slogans copied from other countries, but not applicable to the conditions of this country. Worst are the divisions, and parties formed on a religious basis. There is a great dearth of Directive and Creative Political Thought, as post-war Russia had in Marxism or China has since 1923, in the famous "Three Principles of the People" (San Min Chu I) enunciated by Sun Yat Sen, the father of the Chinese Revolution. Politicians in this country mostly emphasize the non-essential and neglect the essential and an absence of political and economic direction is acutely felt.

*APPENDIX I*

# Stalin Prizes for Scientific Achievements

STALIN PRIZES WERE INSTITUTED by the Soviet Government in 1939 in honour of the 60th birthday of Joseph Stalin. That year 94 awards were established, but later the number was increased considerably.

The Government has awarded the title of Stalin Prize Winner (Stalin Laureate) together with large monetary awards (up to 200,000 roubles) to outstanding scientists, inventors, designers, writers, poets, musicians, painters, sculptors, actors and others.

The awarding of the Stalin Prizes has become an annual national event, a celebration and a review of Soviet culture. Stalin Prizes, which aim at fostering the creative spirit in all fields of science and art, are given to innovators who have distinguished themselves by their creative daring and blazed new paths in science, literature, art, industry. The prizes are bestowed by the Council of People's Commissars of the U.S.S.R., but before this is done the services of the candidates for Stalin Prizes are generally considered by the people. *Candidates for Stalin Prizes are nominated by scientific, cultural and public organisations; the value of their work is judged by outstanding authorities in the various fields of science, literature and art.* The names of those people adjudged Stalin Prize winners are given wide publicity in the press.

**Stalin Prizes of 1941—43**

In the three years 1941-43, Stalin Prizes were awarded to people in various walks of life, from academician to worker.

Among the Stalin Prize recipients for these years we find the names of Academicians P. Kapitza and M. Pavlov, known to the whole scientific world. Side by side with them we have the Steel-worker I. Valeyev of the Ural Machine Building Plant, I. Zavertailo, a miner, and S Davydov, tool-maker of the Stalin Automobile Plant of Moscow.

Academician Kapitza has received the prize twice, once for his methods of obtaining liquid air and liquid oxygen, and the second time for his discovery and study of the super-fluidity of liquid helium. Academician Pavlov, founder and leader of the Soviet school of metallurgists, who has trained many engineers and scientific workers, is the author of the classical work, "*The Metallurgy of Cast Iron.*"

IN **1943—44** Soviet scientists and technologists whose names appeared on the list of Stalin Prize awards for 1943-44 include the following:

A Stalin Prize was awarded to the team of physicists headed by Academician S. I. Vavilov for outstanding discoveries and investigations of the motion of electrons in a dense medium with a velocity greater than that of light in that medium.

A prize of 100,000 roubles was awarded to Konstantin Petrovich Petrzhak, senior scientist of the Radium Institute of the Academy of Sciences of the U.S.S.R.; and to Georgi Nikolayevich Frelov, senior scientist of the Academy of Science of the U.S.S.R. for the discovery of the phenomenon of the spontaneous disintegration of uranium atoms.

The young Soviet astro-physicist V. A. Ambartsumian, Vice-President of the Armenian Academy of Sciences, has been honoured for his new theory of the

diffusion of light in turbid media. This research work is of great importance for the solution of a number of astro-physical problems, and for obtaining visibility under water, in fog, and so on.

A Stalin Prize has been awarded to the eminent mathematician M. A. Lavrentyev, Vice-President of the Ukrainian Academy of Sciences, for evolving a new mathematical method for solving non-linear problems in the field of differential equations with partial derivatives. This method has had a wide application in solving various problems of hydro and aero-mechanics and is of great interest for Soviet aviation.

Academician Rodionov has won an award for his achievements in the field of chemistry, especially for his work on the synthesis of amino-acids and complex heterocyclic compounds. Academician A. N. Terenin has been awarded a first-class prize for his researches on photo-chemical processes.

Professor Baikov of the Naval Medical Academy received a prize for his work on "the cerebral cortex and internal organs." He has developed the teachings of the famous Russian biologist Pavlov on higher nervous activity, opening up a new sphere in physiology.

One of the most interesting awards in the field of technological sciences was that to the team headed by Professor Aseyev of the Leningrad Mining Institute. Aseyev's team conducted research on ores essential to non-ferrous metallurgy, in particular copper and nickel ores, and evolved new methods of concentrating these ores and of smelting metal from them.

Rear-Admiral Papkovich, corresponding member of the Academy of Sciences, has been awarded a prize for his two-volume work on "The Mechanics of Shipbuilding". Professors Drodnitsyn and Loytsyansky

received prizes for outstanding work in the field of aerodynamics.

A prize has been conferred on the team of engineers headed by N. P. Ivanov who was responsible for the powerful hydro-turbines and generators installed at the Sheksna and Uglich hydro-electric power stations of the Upper-Volga net work. The 55,000 kilowatt turbine produced by this team is the most powerful of its type in the world.

A group of prize-winners headed by M. I. Grinberg produced a new turbo-generator with a capacity of 100,000 kilowatts, making 3,000 revolutions per minute.

For creating new models of high-speed and powerful diesel engines for vessels, a Stalin Prize has been awarded to the team of engineers working under Kazyakin and Matveyev.

Many geologists were among the prize-winners. Yerofeyev has been honoured for his discoveries of new deposits of tin; Karzhavin, for creating an aluminium base in the Urals, Yengurazov and Kuznetsov were responsible for exploring and exploiting the Yelshansk sources of natural gas near Saratov.

Among the representatives of medical science in the list of awards is Professor Voino-Yasenetsky, consulting surgeon to the evacuation hospitals of the Tambov Region, who has been honoured for his work on new surgical methods in healing septic diseases and wounds. Prizes were also conferred on Professor Bayandurov of the Tomsk Medical Institute and Professor Rauer of the Central Institute for doctors.

**In 1945** For outstanding scientific work in 1945, the following were among those to whom Stalin Prizes were awarded.

One first prize of 200,000 roubles and four second prizes of 100,000 roubles have been awarded for work in

physics and mathematics. The first prize went to Ivan Vasilyevich Obreimov, corresponding member of the Soviet Academy of Sciences and Director of the Academy's organic Chemistry laboratory, for work in the sphere of optics and crystal physics, contained in a paper published last year on the application of Fresnel diffraction to physical and technical measurements.

A second prize has been awarded for the discovery of new forms of fission of atomic nuclei caused by cosmic rays. It went to Dr. A. P. Zhdanov for work described in his paper "Anomalous Fission of the Nuclei of Bromine and Silver by Cosmic Rays," published in 1945.

Corresponding member of the Academy of Sciences N. M. Vul, Director of the "Lebedev" physics laboratory, won a second prize for the discovery and investigation of super high dielectric permeability of titanate of barium. His results were published in four papers last year; on the dielectric permeability of the titanates of metals of the second group, and on the dielectric permeability of barium titanate as a function of pressure, as a function of tension in an alternating field, and at low temperatures.

M. S. Molodentsky, of the Central Institute of Geodesy, Aerial Photography and Cartography, won a second prize for his work on "Basic Questions of Geodetic Gravimetry"; and Dr. A. I. Maltsev, of the "Staklov" Mathematical Institute, for four mathematical papers on the theory of groups: "The Semi-simple Sub-groups of the Li-Groups," "The Commutative Sub-Algebras of Semi-simple Li-Agebras," "On the Solvable Li-Algebras" and "On the Theory of Li-Groups as a Whole," all published in 1945.

For chemistry, a first prize of 200,000 roubles was awarded to Professor I. N. Nazarov, director of the laboratory of the Soviet Academy's Institute of Organic Chemistry, for research on acetylene and its derivatives, described in papers published in 1945.

Work on the physiology on the higher nervous system wins a first prize (200,000 roubles) for the director of the laboratory of the "Pavlov" Institute of Physiology, Dr. Maria Petrova.

Three first prizes (200,000 roubles each) were awarded for medical research. One went to Professor D. M. Zhdanov, corresponding member of the Academy of Medical Sciences, for work on the anatomy of the lactile duct and the main lymphatic collectors. The other two went to N. L. Polenov, director of the Leningrad Neuro-surgical Institute, and Dr. A. V. Bandurchuk, of the same institute, for research on neuro-surgery and the elaboration of an original operation.

In the sphere of history and philology, first prizes of 200,000 roubles have been awarded to the authors of volumes 2 and 3 of "The History of Diplomacy," published in 1945: Academicians V. P. Potemkin and E. V. Tarle, Professor V. M. Khvostov, and corresponding members of the Soviet Academy I. I. Minz and Anna Pankratova. Hero of Socialist Labour, Academician I. I. Meshchaninov also wins a first prize of 200,000 roubles for work on philology.

*APPENDIX II*

# Scientific Research in Russia outside the Academy

IN ADDITION TO THE WORK done in the Institutes under the Academy, U.S.S.R. has the following research organizations.

Research Institutes under People's Commissariats. (Research Institutes are attached to the various People's Commissariats (Government Departments or Ministries), both to the All-Union Commissariats (such as those of Foreign Trade, Railways, the Oil Industry, etc., which are directly responsible to the Central Government), and to the Union Republican Commissariats (such as those of the Food industry, Textile Industry, Public Health, etc., which exist in each of the 16 Republics of the Union, the 16 Commissariats covering a given subject, being themselves co-ordinated by a corresponding body in Moscow).

In accordance with the distribution of Commissariats provided for in the Constitution of the U.S.S.R. the scientific research institutes under the various People's Commissariats are also divided into All-Union Republican institutions.

Among the All-Union Commissariats which have research institutes under them are the Commissariats of Foreign Trade, Railways, Post, Telegraph and Tele-

phones, Maritime Fleet, River Fleet; Industries of Coal-Mining, Oil, Electric Power Stations, Electrical Engineering, Iron and Steel, Non-Ferrous Metals, Chemical, Aircraft, Shipbuilding, Munitions, Armaments, Heavy Machine-Building, Medium Machine-Building, General Machine-Building, Navy, Agricultural Stocks, Civil Engineering.

Among the Union-Republican People's Commissariats which have research institutes under them are the People's Commissariats of Food, Fishing, Meat and Dairy Products, Light Machineries, Textiles, Timber, Agriculture, State Grain and Live-stock Farms, Finance, Trade, Internal Affairs, Justice, Public Health, Building Materials, Education, Local Industry, Municipal Economy, Social Maintenance, Motor Transport, Foreign Affairs and Defence.

**The Research Institutes under Universities**

The Research institutes, which form component parts of universities in the U.S.S.R., carry out extremely diverse scientific work both in the university institutes and laboratories and in the special departments and scientific circles, libraries and societies in which the student body and the University teaching staffs are united and which are characteristic of regular educational institutions and also of correspondence courses.

*Whereas in* 1917 *Russia had only* 91 *universities and colleges and* 289 *research institutes, employing* 4,340 *scientists, in* 1939 *the U.S.S.R. had* 700 *universities and colleges; and* 908 *research institutes staffed with* 26,246 *scientists.*

In the universities and colleges of the U.S.S.R. science is organized on the principle of the direct and lively participation of the professorial staff and of the regular and post-graduate students in the investigation of the vital problems of science and engineering.

More than 800 subjects are being investigated in the institutes and laboratories by the staff members of the Moscow University, for instance. Since the war the University has solved many problems of vital military and economic importance.

The Institute of Mathematics of the Moscow University is continuing to work on the qualitative theory of differential equations, topology, the theory of probability and others.

The results of the work done by the Institute of Mechanics of the Moscow University on the elastic-plastic deformation of metal are being widely applied in the designing bureaux of industrial research institutes.

Registering devices called "time magnifiers" and "radium clocks" have been invented in the astronomical instruments laboratory organized in the Institute of Astronomy of the Moscow University since the war.

Associates of the Institute of Chemistry of the Moscow State University have devised a method of producing frost resisting caoutchouc. This method will be widely used in practice.

The department of the dynamics of the development of organisms in the Institute of Zoology of the Moscow University is doing interesting work on animal fecundity.

The fruitful work of the Moscow University has received high recognition from the Soviet Government in 1945; eleven professors were awarded Stalin prizes for their work.

In 1944, the university arranged to publish several volumes of scientific notes on *"The Role of Russian Science and Culture in world Science and Culture."* The most prominent scientists in all the faculties of the

University are contributing to this series. The publication will reflect the development of Russian science and culture in the years of peaceful construction and in the war of the Soviet Union against Nazism.

The role of the Russian nation in the development of world science and culture was discussed at a big conference organized by the University in June, 1944.

Since the war the humanitarian faculties of several institutes—philological, philosophical, law and economic were merged with the University.

The inflow of students in 1943 was so great that the University could not admit all the applicants. The 1,700 who were accepted were those who had the best results in the entrance examinations. The faculty of international relations for instance, had only 200 vacancies, while more than 2,000 applications were submitted.

**Extension of Programme of Studies**

The great interest which Soviet youth is showing in history, culture and art, and, in particular, in the culture of the Western and Southern Slavs, had made it necessary to extend the programmes of study. Courses in Slav philology are now being offered by two departments instead of one: the department of Slav literature and Slav philology. An eastern department has been opened with courses in Iranian and Turki philology. The historical faculty has enlarged its course in the history of the U.S.A. and England. A scientific section has been organized in this faculty to study unpublished archives. At its meetings the section hears reports on the history of the political and cultural relations between Russia, the U.S.A., and Great Britain.

The students of the physics faculty are becoming acquainted with the latest achievements of Soviet

Science in two new departments of the Moscow University, which has been decorated with an order by the course in the physics of low temperatures, and under Professor V. V. Shuleikin, corresponding member of the Academy of Sciences of the U.S.S.R., who is giving a course in the physics of the liquid envelop of the earth.

The hero-city of Leningrad is proud of its university. The scientific personnel of the Leningrad university, which has been decorated with a order by the government, has displayed an exceptionally high patriotic spirit and creative initiative. Neither hunger, nor cold, nor furious air raids, nor artillery bombardment could break the will and the spirit of this heroic body of people. Even in the most trying months of the siege the scientific workers of the University continued their educational and practical scientific work It suffices to note that until the middle of 1942, that is, until their evacuation to Saratov, the associates of the University solved more than 70 vital practical scientific problems. Many of them are of vital importance to defence, as, for instance, Professor Ambartsumian's work on photometry, Academician Fock's work on improving firing accuracy and the work of the biochemical department on combating gas gangrene in wounds.

**Research work under Scientific Societies**

Research work (likewise the mass propaganda of science among the citizens of the U.S.S.R.) is also carried on in the scientific societies of the U.S.S.R. in their scientific institutes and sections. Thus, for instance, the Moscow Society of Naturalists, founded in 1805, had the following scientific sections in 1940: zoology, botany, geology, hydrobiochemistry, geography, biophysics, paleontology, histology and experimental morphology, and conducted as it still does to-day, considerable research work and popularizing work.

Medical Research in the U. S. S. R. has not been dealt with under the above headings.